AUGUST 1950

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INDUSTRY AND POWER

A Magazine for the Plant Engineering Group

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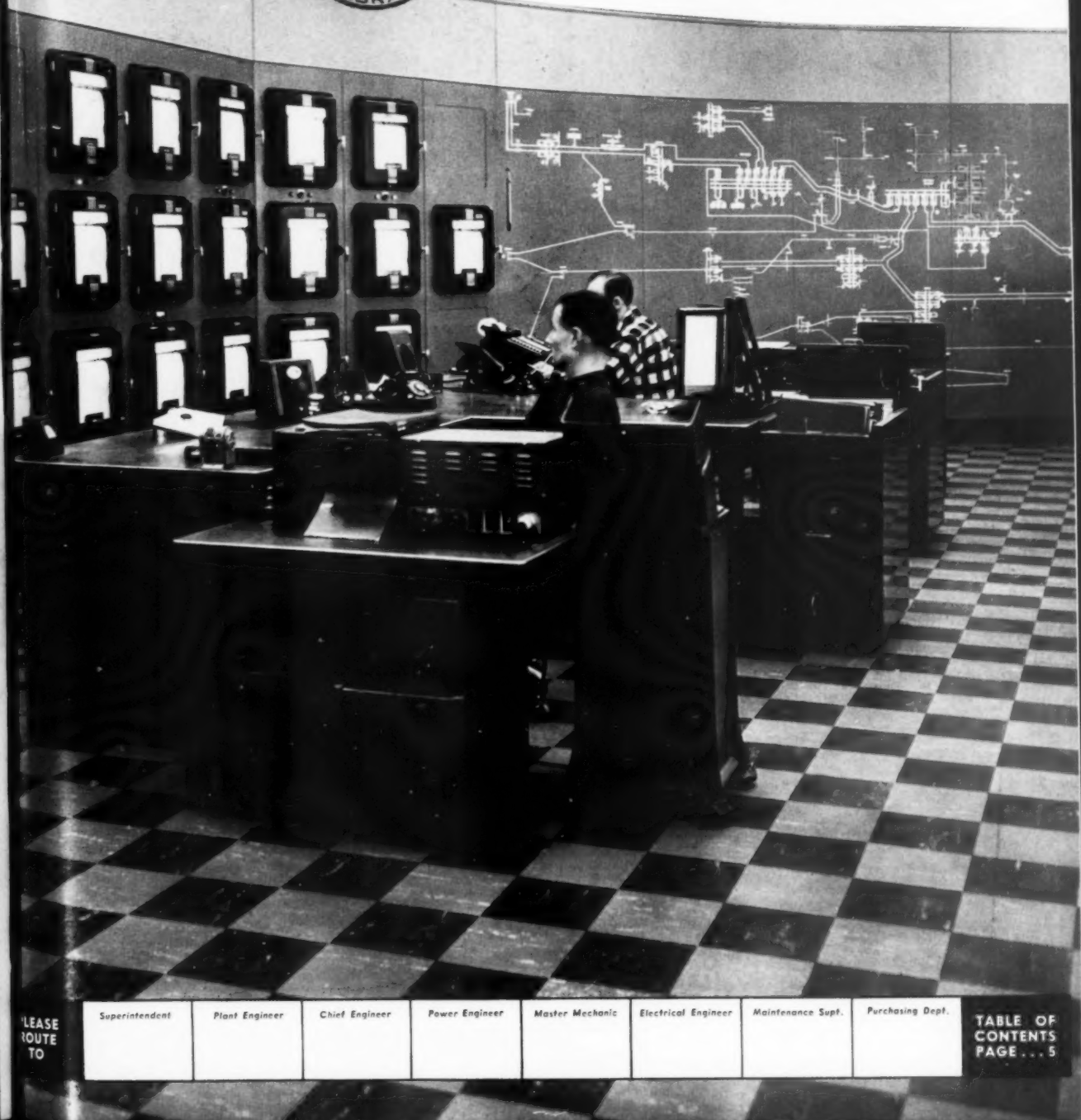

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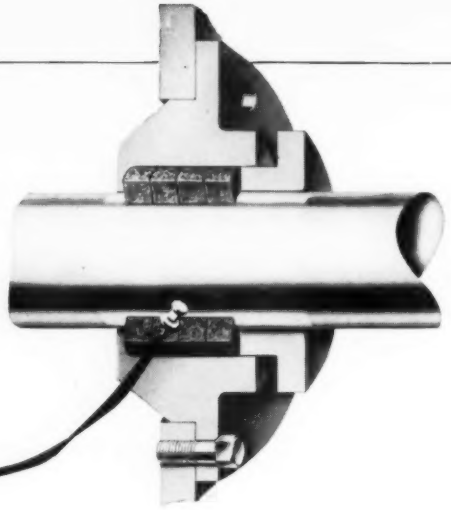
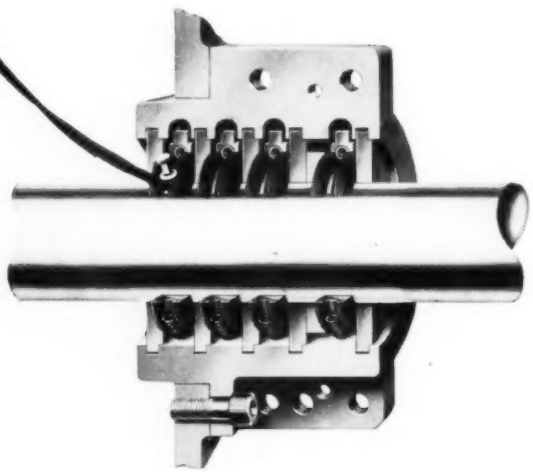
COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



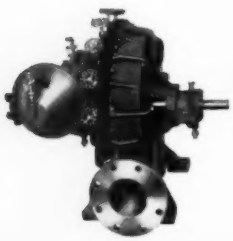
OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORPORATION
188 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

Edited specifically for the plant engineering group—the executives and engineers responsible for the generation, transmission, distribution and utilization of energy in its various forms for power, processing and engineered services

INDUSTRY AND POWER

The Magazine for the Plant Engineering Group

VOLUME 59 **AUGUST, 1950** NUMBER 2

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Cover Illustration

Load dispatchers of Indiana & Michigan Electric Co. are equipped with both carrier current and regular telephones, as well as two-way radios for communication with line trucks and trouble cars.

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New Test for

WATER HARDNESS

Taylor Total Hardness Set ends inconvenience and errors of soap tests

Now you can test boiler water for total hardness without the inconvenience and errors of the old-fashioned, time-consuming soap test.

With this new Taylor Set, determinations of hardness can be made in just a few minutes on waters up to 1400 p.p.m. . . . it can also be used as a control test on zeolite or lime-soda treated waters.

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1. Merely place the 50 cc. sample to be tested in a 250 cc. flask with 2 drops of Taylor Hardness Indicator and 1 cc. of Taylor Hardness Buffer.
2. Add Taylor Hardness Reagent from a burette until the red color, indicative of hardness, changes to blue.
3. When the color changes to blue the burette reading in cc. is multiplied by the control factor, in this case 20, to give you the total hardness.

Since one simple titration with Versenate does the whole job, you get your determination faster and easier. Since the color change provides positive visible evidence of the end point, your reading is far more accurate than the soap test method.

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INFORMATION TODAY

Each Taylor Total Hardness Tester is sold complete . . . includes all necessary equipment and reagents. Write direct for prices or further information. Also ask for the Taylor Handbook, "Modern pH and Chlorine Control".

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Apropos of—

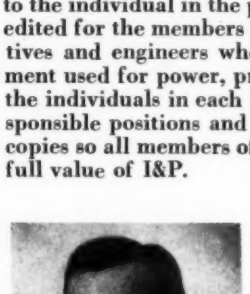
Selectivity

WHEN the card imprinted with your company's name has run the gauntlet of our circulation department and is stamped "approved—add to circulation list", we are paying your company our highest compliment.

It's a sincere compliment because each company on our list has been selected with the utmost care to make sure we send I&P only to America's best plants. It's a continuing compliment, too, because our list is constantly checked by our circulation department staff to make sure each plant continues to qualify for I&P.

How does a plant earn our stamp of approval? First, we consider the boiler horsepower rating and have established the minimum at 200. In conjunction with the boiler rating, we have established a co-standard which reads, "or a total motor horsepower rating of 500". The second requirement calls for a financial rating of at least $125,000. As a third consideration, we use the standard of 100 employees minimum and temper that with the industry classification into which the company falls. This industry classification is a necessary safety valve for the 100 minimum employee standard and enables us to eliminate such plants as garment factories, employing hundreds of personnel for handcutting and sewing operations, but with small power requirements. Because of the editorial direction of I&P, there would be little of interest or value to a plant unless it required appreciable power and engineered plant facilities in its operations. Obviously, we don't exclude a plant just because it fails to measure up *exactly* to *each* of these requirements. If the company is financially sound, has the type of operations and personnel which coincide with the interest scope of I&P, and if it has shown growth and steady improvement, that plant belongs on our list now because it will soon meet any requirement.

The *selectivity* of our placement program is carried one step further to the individual in the plant. The editorial content of I&P is specially edited for the members of the Plant Engineering Group—those executives and engineers who select, install, operate and maintain equipment used for power, processing and engineered plant services. Thus, the individuals in each plant who are selected to receive I&P have responsible positions and realize the importance of passing along their copies so all members of the Plant Engineering Group may obtain the full value of I&P.

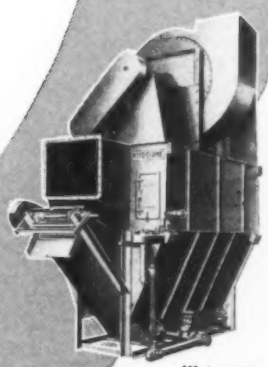


It's you, the individual in your Plant Engineering Group, who in turn have given us your highest compliment. You have given your approval to I&P and that has been the key to our success. As our circulation department checks the quality of your plant, you are continually checking the quality of I&P and only as that quality is maintained and improved do we rate your constant interest and readership. As you know, we regularly ask questions and favors of you, so let us know promptly whenever we can be of help. We're always glad to assist you in every possible way.

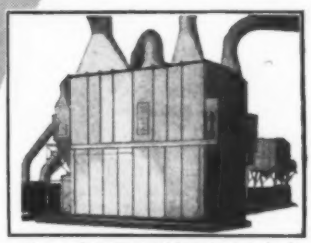
L. E. Aist

Publisher

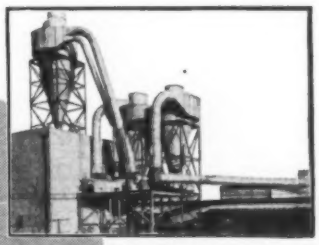
WHAT KIND OF DUST CONTROL APPARATUS *does your operation require?*



Wet process air cleaning using "Rotoclone."



Clean dry returnable air required. Cloth filter selected.



Centrifugal separator suitable for heavy dust concentration.

Combination of centrifugal separator and dry filter.

If all dust and fume control problems were alike, there would be no need for specialized engineering service. But these problems vary widely, depending upon manufacturing processes and raw materials used, including many recently developed materials which present entirely new problems. For these reasons, selection of the right units for a really efficient dust or fume control system is definitely a job for engineering specialists.

Kirk & Blum with 43 years of experience in this field, first makes a thorough analysis of your special dust or fume control problem. Next, our Staff selects the right units for your job from among the various makes available—then designs and installs a complete system that is guaranteed by Kirk & Blum to give the results you want.

Play SAFE . . . get the unbiased counsel and planning of experts. For details write to The Kirk & Blum Manufacturing Co., 2874 Spring Grove Ave., Cincinnati, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST AND FUME CONTROL SYSTEMS

new equipment and developments

You can easily get more data on these new equipment and development items. Use the handy, postage-free order cards on Page 37. Just list the key numbers of the descriptive paragraphs in the spaces provided on the card and mail.

301—VALVE HANDLES ACIDS SAFELY

Valve developed to handle concentrated sulfuric acid and other highly corrosive fluids has a diaphragm, which greatly reduces maintenance problems. Molded of Bakelite Div., Union Carbide and Carbon's polyethylene plastic, the diaphragm can handle all concentrations of sulfuric acid, up to and including oleum, at a maximum

of 10% excess sulfur trioxide, at temperatures up to 125F. The valve has "O" ring seals in the bonnet assembly to prevent acid from spraying out if mechanical damage should occur to the diaphragm. Available in ½, 1, 1½, 2 and 3-in. sizes with either flanged or screwed end. It is made in a wide selection of body materials such as cast iron, cast steel, lead and glass-lined.

302—TACHOMETER GENERATOR FOR HAZARDOUS PLACES

Type E tachometer developed by Weston Electrical Instrument Corp. has been specifically designed for use in explosive atmospheres. Available as either an a-c or a d-c generator, this type is listed by Underwriters' Laboratories, Inc., for use in two classes of hazardous locations: Class I, Group D and Class II, Groups F and G. It is particularly suitable in oil refineries, chemical plants, grain elevators, flour mills, coal mines and similar locations.

This tachometer generator is enclosed in a cast iron housing that measures approximately 10¼ in. overall and 4½ in. in diam. Its ¾ in. diam stainless steel shaft, with a machined flat for a gear or coupling, extends 1½ in. beyond the bearing support. Electrical connection is made in a terminal box tapped to take standard ½ in. conduit.

A-c generator, Model 758, is of the rotating magnet type and is suitable for speeds up to 5,000 rpm. Higher speeds can be accommodated on special order. It can be operated in either direction, but the associated indicator will always read in one direction.

Model 750 d-c generator has a wound armature with commutator and brushes, and it operates at speeds up to 2,000 rpm in either direction. The associated indicator can be adjusted to read in either direction. Both d-c and a-c generators are available in the new housing.

303—INSULATED TOOLS ARE SAFE, DURABLE

Especially designed for live work involving dangerous voltages, Cohardite insulated tools are being introduced by H. K. Porter, Inc. They provide an extra margin of safety and protection for personnel and equipment. Cohardite was developed specifically for the insulation of hand tools. It maintains its high dielectric strength over the extreme range of working temperatures and in the presence of moisture, oil or acid fumes.

Tools in the line include meterman's screwdrivers (factory-tested to 5,000 v), standard screwdrivers and socket wrenches (factory-tested to 10,000 v) and wire cutter and fireman's cutters (factory-tested to 20,000 v).

304—VARIABLE TRANSFORMER IS EXPLOSION PROOF

Superior Electric Co. has announced an addition to its line of variable transformers—the explosion proof powerstat. This unit provides a safe means of obtaining a continuously-adjustable source of a-c voltage in hazardous areas where a small arc or

spark could cause an explosion. The model consists of a variable transformer totally enclosed in a case, which will withstand internal gas or vapor explosions. Underwriters' approved for Class 1, Group D service, the devices are available in 115 and 230-v single phase operation.

305—THYRATRON HAS GOOD COMMUTATION FACTOR

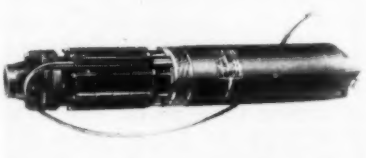
Grid-controlled, inert-gas rectifier thyratron, announced by the Westinghouse Lamp Div., is a three-electrode, temperature-free tube designed for industrial control and ignitor firing service.

Maximum peak anode potential, both inverse and forward, is 1500 v. For general control service, maximum cathode current is 20 amp peak, 1.6 amp average. In ignitor firing applications, the tube's maximum cathode current peak is 30 amp and the average 0.5 amp. For both types of applications, maximum negative control grid potential before conduction is 250 v; after conduction, 10 v. Maximum commutation factor rating is 10 v, and the tube can be used in polyphase rectifiers on inductive

loads with very small or no cushioning circuits. The cathode potential is 2.5 v and heating time is 10 sec. The tube utilizes air convection cooling and can be operated in any position. It has a net weight of 3 oz.

306—ELECTRICAL PUMP OPERATES SUBMERGED

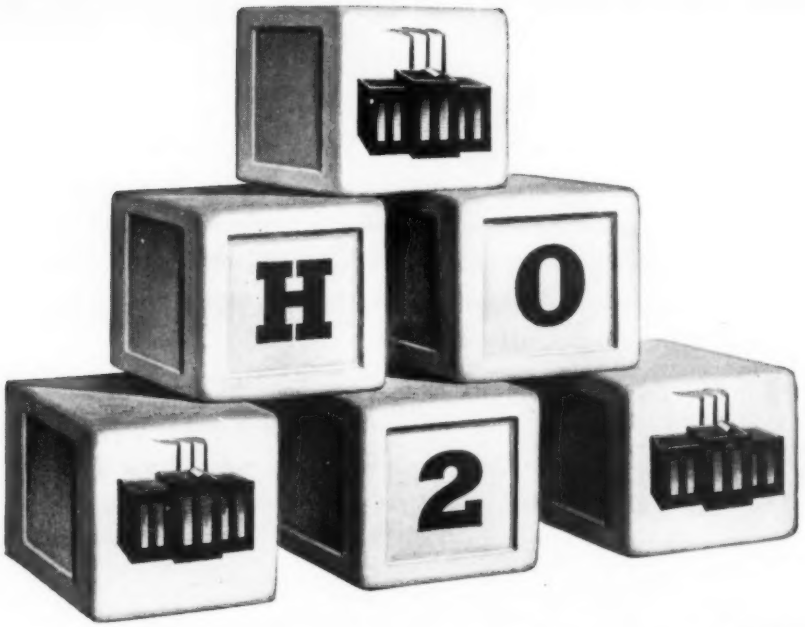
Sumo Pumps, Inc. announce a line of electric submersible pumps that range in size from 0.7 to 60 hp with capacities from 5 to 1250 gpm. Pump and motor are assem-



bled as a unit and are designed to operate completely submerged in water. Installation is effected simply by lowering the pump on its riser pipe to the proper depth and connecting a submarine power cable to a convenient source of electric power supply.

Bronze and stainless-steel construction

(Continued on page 12)



HOW TO BUILD PROFITS!

WATER, which is a basic requirement of industry, is seldom suitable for use in its natural state. Adequate protection from the many hazards which accompany the use of incorrectly or inadequately conditioned water, whether for boiler, cooling or process use, is one positive way to increase plant efficiency . . . *and build profits!*

For over two decades BETZ has provided engineering guidance and developed control procedures for the correction and prevention of all water difficulties. If the results you are presently obtaining are not fully satisfactory, our nationwide staff of engineers welcomes the opportunity to discuss your water problems. Why not start building profits *today?* W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pennsylvania. In Canada: BETZ Laboratories Limited, Montreal 1.

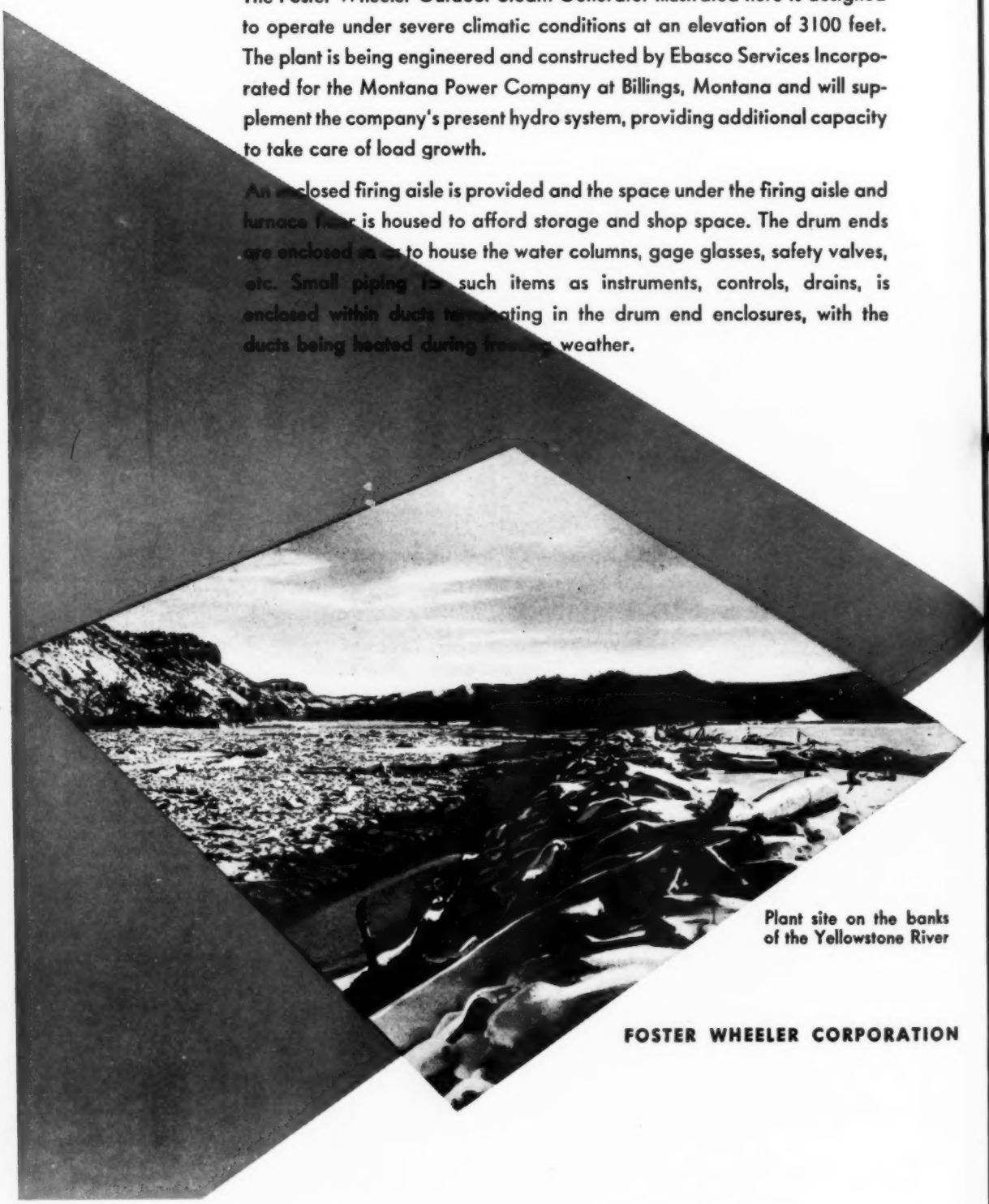
BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

"operation" SUB-ZERO

The Foster Wheeler Outdoor Steam Generator illustrated here is designed to operate under severe climatic conditions at an elevation of 3100 feet. The plant is being engineered and constructed by Ebasco Services Incorporated for the Montana Power Company at Billings, Montana and will supplement the company's present hydro system, providing additional capacity to take care of load growth.

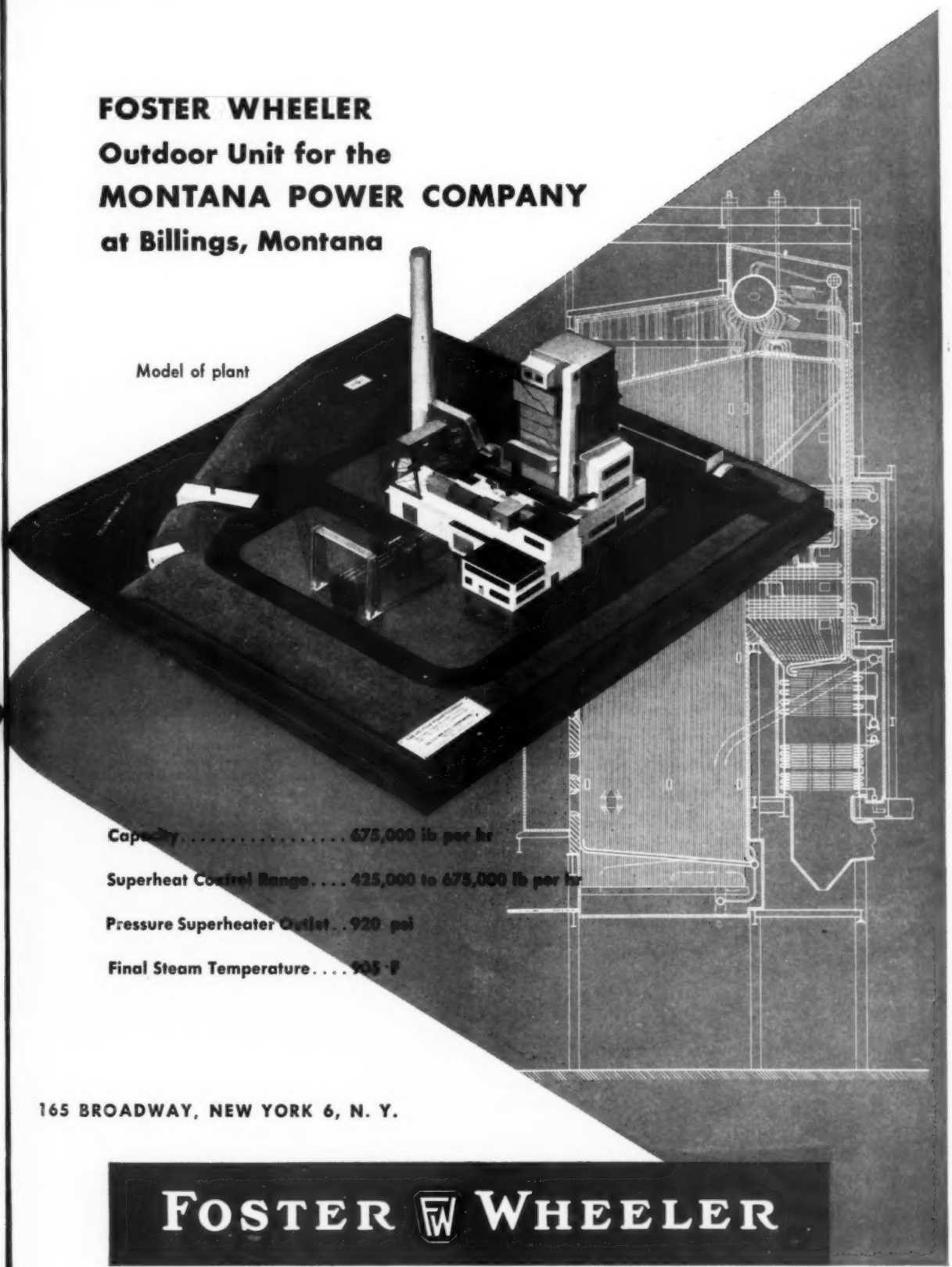
An enclosed firing aisle is provided and the space under the firing aisle and furnace floor is housed to afford storage and shop space. The drum ends are enclosed as well to house the water columns, gage glasses, safety valves, etc. Small piping for such items as instruments, controls, drains, is enclosed within ducts terminating in the drum end enclosures, with the ducts being heated during freezing weather.



Plant site on the banks of the Yellowstone River

FOSTER WHEELER CORPORATION

FOSTER WHEELER
Outdoor Unit for the
MONTANA POWER COMPANY
at Billings, Montana



Model of plant

Capacity . . . . . 675,000 lb per hr

Superheat Control Range . . . . 425,000 to 675,000 lb per hr

Pressure Superheater Outlet . . 920 psi

Final Steam Temperature . . . . 905 F

165 BROADWAY, NEW YORK 6, N. Y.

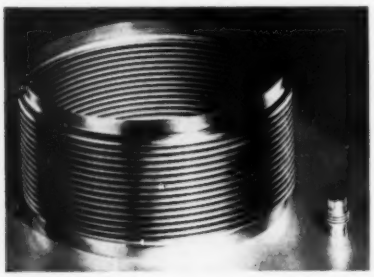
FOSTER WHEELER

(Continued from page 8)

throughout, the pump and motor are especially built for underwater operation. Motor is of the dry-stator type with the rotor running in and cooled by water.

307—STAINLESS STEEL BELLOWS LINE NOW COMPLETE

Chicago Metal Hose Corp. stainless steel bellows are now available in a complete range of sizes, and are ideally suited where problems of pressure, high and low temperatures, and corrosion are factors. Es-



pecially adopted for control devices and instrumentation such as regulators, valves, steam traps, shaft seals, expansion connections and flexible connectors for misalignment. CMH stainless steel bellows are manufactured in single and multi-ply construction in various lengths.

Bellows or bellow assemblies with standard or customer's specifications can be supplied. Fitting attachments may be joined by electrical, circular seam welding to assure leakproof unit metal assemblies.

309—MINIATURE VOLUME PUMP OPERATES AT 1000 PSI

Miniature controlled volume pump, manufactured by Milton Roy Co., handles minute quantities of clear liquids in precise volumes at pressures up to 1000 psi. It is available

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

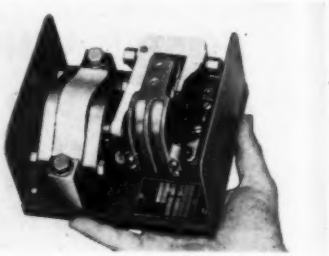
in simplex or duplex types, powered by a 1/20 hp motor, and as a simplex pump powered by a 1½ in. reciprocating air cylinder.

Liquid end is double-ball-check design; construction is stainless steel; and plunger stroke length is adjustable, while operating, from zero to full rated capacity. Ball-checks are available in glass, precision 440 stainless steel or sapphire balls. Maximum capacities vary from as low as 16 to 3740 milliliters per hour, depending upon stroking speeds, stroke lengths and plunger size.

310—MAGNETIC AIR VALVE HAS ROTARY ACTION

Rotary action in a magnet-operated air valve, developed by the Square D Co., permits high capacity and fast operation in extremely small size. Overall dimensions are 4 in. wide, 6½ in. high, and 5¾ in. deep. This device is designed as a four-way, four-port, ⅜ in. valve, for control of double-acting air cylinders. It can be converted to three-way, or two-way operation, by plugging the proper ports. Pressures up to 100 psi can be handled. Operation is continuous at 300 cycles per minute, and at speeds up to 600 cycles per minute on intermittent duty. Power consumption is held to the minimum. Magnet coil requirement is 38 va at 60 cycles and 215 va inrush.

Valve body and rotor are manganese bronze. The rotor is pressure-balanced to



minimize bearing wear and has spring loaded vanes to insure positive seal. All magnet parts are hardened for maximum strength and durability.

311—RESIN TAPE UNAFFECTED BY CORROSIVE ELEMENTS

Layers of insulating and splicing tape, based on Bakelite Div., Union Carbide and Carbon's polyethylene resins, weld into a continuous elastic skin within a few minutes after wrapping around a cable splice or tool

handle. The plastic base keeps the self-bonding tape flexible despite severe weather conditions and is unaffected by temperatures ranging from 120 to as low as —30F. It is unaffected by corrosive fumes, ozone, sunlight and oxygen. Both clear and black forms of the tape are available.

312—PRECISION INSTRUMENT OILS STAY ON BEARINGS

Synthetically tailored lubricants, recommended for use in virtually all fine precision instruments, are being introduced by the Gulf Oil Corporation.

The lubricants, Gulf Special Instrument Oil and Gulf Micro Bearing Oil, are the result of years of research by the Elgin National Watch Company working in collaboration with the Gulf Research Fellowship at Mellon Institute of Industrial Research.

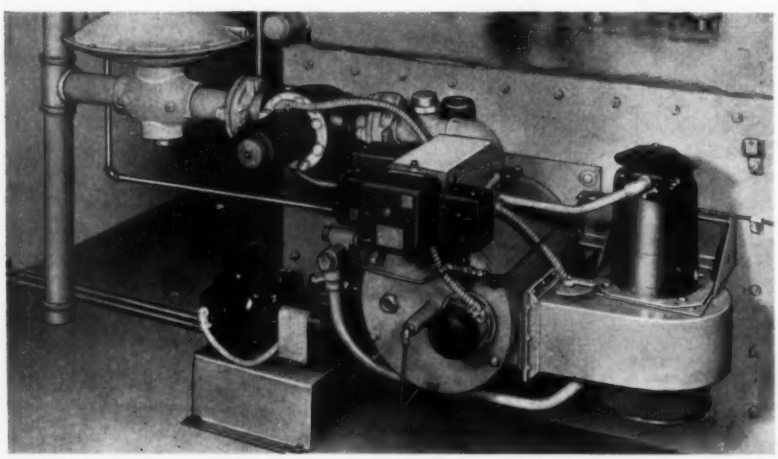
The two oils are wholly synthetic products with special properties which adapt them particularly to the lubrication of small, delicate, low-torque bearings encountered in precision instruments. They "stay put" over long periods of time when applied in minute quantities, are highly resistant to oxidation and are exceptionally low in volatility, operating for long periods with a minimum of gumming.

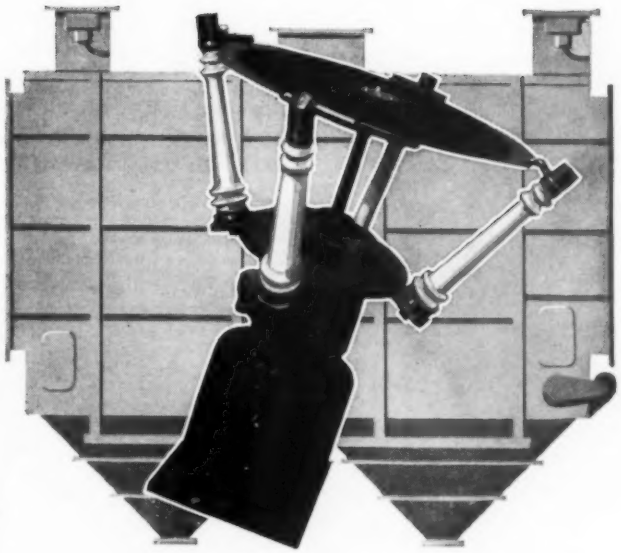
(Continued on page 14)

308—BURNER UTILIZES GAS OR OIL FUEL

Changing from gas to oil (or vice versa) by merely throwing switches is one of the main features of the North American Mfg. Co. Series 116 DF package boiler burner unit. This automatic dual-fuel unit is made in two sizes covering a range of 1½ to 3¾ million Btu input for industrial and commercial heating or processing boilers. It burns #3 oil, or lighter, and natural or mixed gases. This unit is factory wired and completely assembled. It includes all electronic controls and the latest flame safety devices. An integral blower furnishes all necessary combustion air and an electrically ignited ignition blast pilot assures positive main flame ignition. Gas regulators and oil pumping equipment are included.

Operation of the burner is "on-off" in response to operating pressure or temperature limits set to suit. Safety devices shut off burner automatically in the event of flame failure, power failure or failure of any component parts of the burner assembly. Unit is designed for 115 v, 60 cycle power.





ELECTROSTATIC ...YES

DESIGN-STATIC ... NO

The advent of the Buell 'SF' Electric Precipitator breathes new life into precipitator design. High efficiency recovery of ultra-fine dusts, fumes and vapors takes on new operating ease and reliability.

Both management and plant engineers will find in the Buell 'SF' Precipitator sound reason to anticipate superior performance. Advanced design provides self-tensioned Spiralectrodes (patented), and incorporates an exclusive StediFlow dust-fall principle. Either as Precipitator alone, or in combination with Buell van Tongeren cyclones, there is definite operating advantage.

Like all Buell Dust Collection Systems, each 'SF' Precipitator installation is custom-engineered for the job it will do... backed by a realistic fractional efficiency guarantee... produced against a background of world experience in dust collection.

For general information or specific performance data, write Buell Engineering Co., Inc., 70 Pine Street, Suite 4500, New York 5, N. Y.

ELECTRIC CYCLONIC

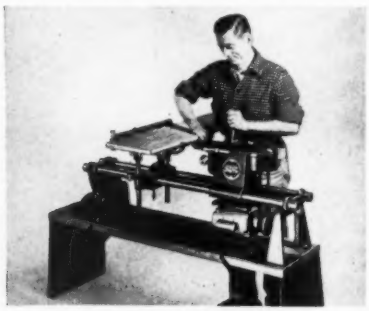
buell

Engineered Efficiency in **Dust Collection**

(Continued from page 12)

313—MAINTENANCE UNIT HAS MANY USES

Maintenance unit, which can be converted into an 8-in. circular saw with extension table, 15-in. vertical drill press, 33-in. lathe, 12-in. disc sander, or horizontal drill press is now available from Magna Engineering



Corp. The horizontal drill press is a power tool for jobs such as dowelling, drilling in the ends of long workpieces, and other jobs that are difficult or impossible on a vertical drill press. Accessories can convert the unit into a jointer, shaper, drum sander, mortiser, jigsaw, and other power tools.

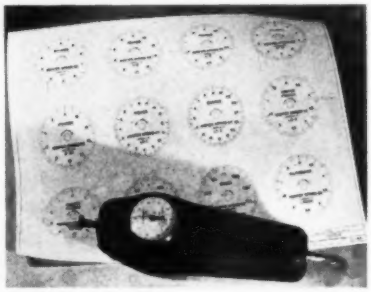
314—BUILDING PANEL RESISTS FIRE

Laminated lightweight building panel of exceptional strength and high insulation value has been introduced by the Owens-Illinois Glass Co. and will be sold in various forms under the brand name "Kaylo." Composed of a 1⅝ in. core insulation faced with ⅛-in. cement-asbestos boards it has unusual structural strength and is resistant to moisture, flame or fungus. Each standard-size panel is 4 x 8 ft., and weighs 200 lb.

Wall erected with this type of panels will withstand an hour's exposure to fire. The light weight of the panel is made possible by millions of tiny air spaces within the material. It has a structural density of 20 lb per ft and is nearly white in color.

316—EXPANDED INDICATOR LINE TO MEET INDUSTRY DEMANDS

Apparatus Div. of Hunter Spring Co. has increased its line of force indicators—a precision force-measuring instrument—to 12 models. The device is available in capacities of one, two, five and 20 lb; 16, 32, 80 and



160 oz; and 500, 1000 and 5000 g. The indicator employs a compensated spring mechanism and a fully jewelled dial to measure and indicate force. Overall accuracy is ½ of 1 scale division of the dial indicator. Shaped for easy one-hand operation, the unit is supplied with six stainless steel force-transmission rod fittings. This gives the force indicator a wide range of usefulness in measuring force by either a push or pulling action.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

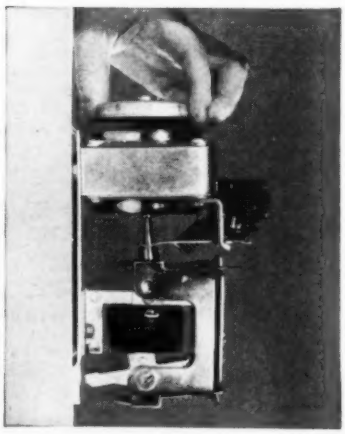
317—VINYL INSULATES THERMOCOUPLE LEADS

Vinyl insulating compound, especially designed for high-temperature service (105 C max.), protects iron-constantan and copper-constantan thermocouple lead wires manufactured by Thermo Electric Co., Inc. Made from Geon, a product of B. F. Goodrich Chemical Co., the insulation is more durable than rubber, and withstands oils and most chemicals at higher temperatures for longer periods. It is used on thermocouple lead wires, 10 to 24 gage, for a variety of pyrometric temperature-measuring applications.

The compound has been found to be non-corrosive toward copper, does not affect painted or varnished surfaces, and exhibits very good outdoor weathering characteristics. High dielectric strength permits thinner insulation walls. It has demonstrated excellent low-temperature characteristics. Also, Geon 8630 has received Underwriters' Laboratory approval for use as electrical tubing at 105 C, and for use as appliance wiring insulation at 90 and 105 C.

318—TIME DELAY RELAYS HAVE WIDE RANGE

Type AM pneumatic time relays, with adjustable delay from 0.2 to 200 sec, are available from Westinghouse Electric Corp. A large graduated dial permits delay ad-



justment throughout this range for general industrial timing functions.

Micro-movement-type precision snap switches with double "make" and "break" contacts (rated at 15 amp, 115 v continuous duty) are used. Additional switches for interlocking purposes can be supplied.

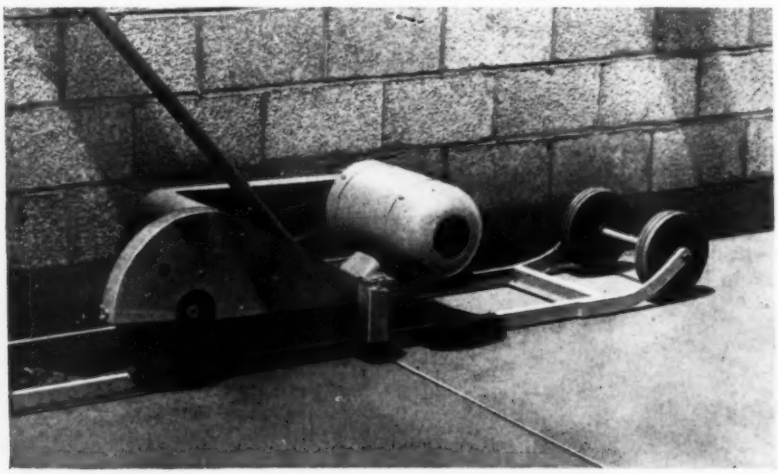
Available as open or enclosed units, the latter in NEMA type I enclosures with conduit knockouts at top and bottom. Operating coils are designed for satisfactory service

(Continued on page 16)

315—CONCRETE CUTTER ONE MAN OPERATED

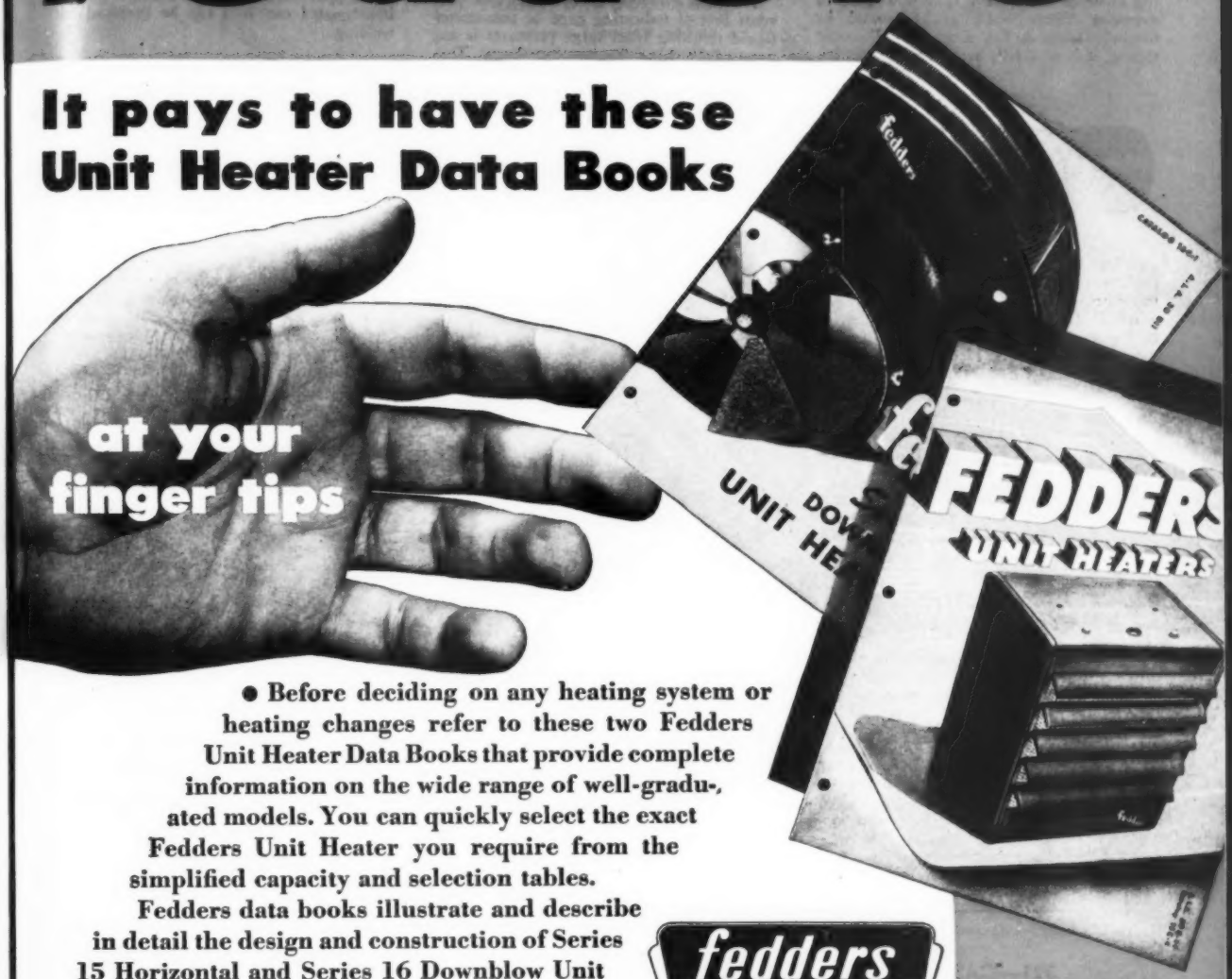
Martin Fireproofing Corp. is featuring an electric motor driven concrete saw on guided rails for either wet or dry cutting. The electric motor assures a smooth constant flow of power, the guide rails guarantee a straight clean cut and eliminate cutting blade breakage. For dry cutting inexpensive abrasive blades can be provided. Specially bonded, abrasive or diamond blades are likewise available for wet cutting.

All working parts are shielded by extra heavy gage sheet steel welded into a single unit. Cutting assembly is pivoted on ball bearings and glides effortlessly over angle iron rails. All weight rests forward on semi-pneumatic tires so the unit can easily be rolled to the job. Emphasis is placed on this fact that both saw operation and moving it about is a one man job and can be done by unskilled help.



fedders

It pays to have these Unit Heater Data Books



● Before deciding on any heating system or heating changes refer to these two Fedders Unit Heater Data Books that provide complete information on the wide range of well-gradu-, ated models. You can quickly select the exact Fedders Unit Heater you require from the simplified capacity and selection tables.

Fedders data books illustrate and describe in detail the design and construction of Series 15 Horizontal and Series 16 Downblow Unit Heaters for use on steam or hot water lines.

fedders
A Great Name Since 1896

Write TODAY for your copies of Fedders Unit Heater Catalogs 15C-4 and 16C-1.

FEDDERS-QUIGAN CORPORATION
BUFFALO 7, N. Y.

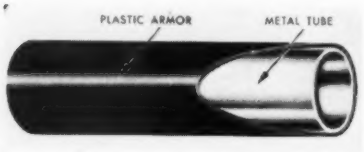
Quigan

(Continued from page 14)

down to 85 per cent of rated voltage. Coils are available in ratings up to 600-v a-c, 25 to 60 cycles.

319—PLASTIC PROTECTS, IDENTIFIES TUBES

Low cost, corrosion-proof instrument tubing made of metal with 1/32-in. coating of extruded thermoplastic is announced by Samuel Moore & Co. Known as Dekoron tubing, it is especially useful in laboratories,



chemical or food processing plants, refineries, etc. The plastic coating is immune to moisture, salt air, oils, acids and alkalies.

Available in ¼ and ⅜-in. diameters, the tubing can be bent like ordinary copper tubing, and the plastic coating also serves as color coding for the line.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

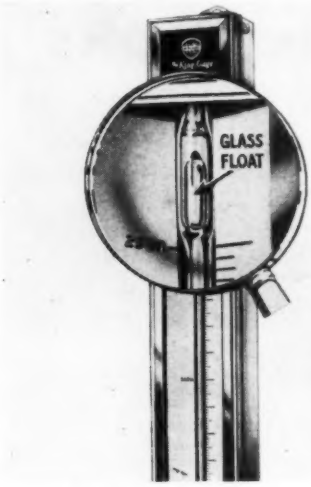
320—CONSTANT-SPEED MOTOR HAS HIGH TORQUE

For use where a constant-speed, high-torque, single-phase motor is required in large ratings, a new repulsion-induction motor has been announced by General Electric Co. Designated as type SCR, the motor is available in 5-, 7½-, and 10-hp ratings, all 1800 rpm. The 5-hp unit operates on 115/230 v, while the other two use 230 v.

The motor features high starting torque and low starting current with positive operation on low voltages, making it well adapted for severe starting duty. To assure good alignment between stator and rotor, the ball bearings are mounted directly in the end shields. Improved brush holders give good brush stability, and brushes and rigging are easily serviced. Efficient cooling is provided by a single large-diameter cast-aluminum fan.

322—OVERFLOW CHECK VALVE MADE OF GLASS

All-glass overflow check valve that prevents loss of indicating gage or manometer liquid resulting from surge pressures is announced by King Engineering Corp. This unit consists of a glass float check in a glass cylinder, which has a seat at the top opening, and a glass tube below for connecting to the instrument. When excessive or surge pressures occur, the float rises instantly to form a perfect seal.



Standard dimensions are 7/16 in. maximum OD, 8 in. over-all height, and 7 mm OD glass connecting tube. Check valves of other dimensions can be furnished.

323—ARC ELECTRODE CUTS WITHOUT OXYGEN

All-purpose cutting electrodes, announced by All-State Welding Alloys Co., cuts, pierces, gouges, chamfers or removes welds without the use of oxygen or special equipment. It operates equally well on either motor-generator or a-c transformer types of welders, it is claimed.

Field tests have indicated that it is suitable on such difficult to cut metals as cast iron, nickel and stainless steel. Its performance on these metals, without oxygen, is better than results experienced in arc cutting with oxygen. It also has proved superior for cutting iron, steel, aluminum, copper, copper alloys, and nickel alloys. Grease-impregnated cast iron can be prepared for welding.

324—SIGHT GLASSES RESIST HEAT

Sight glasses made from Pyrex polished plate glass, have been announced by the Swift Lubricator Co., Inc. They are intended for use as peephole and inspection windows on furnace doors, gas and oil burners, ovens, absorption columns, reaction kettles, evaporators, stills and processing tanks and equipment.

This type of glass withstands sudden temperature changes and has the chemical stability to resist attack by all chemicals except HF and strong hot caustic solutions. Sight glasses are made to order and circles are available up to 16 in. in diameter, with other odd shapes up to 24 in. x 60 in. and up to 1 in. thick.

325—SMALL SAW HAS MANY FEATURES

Low price 6 in. portable electric saw with exclusive features included in larger, higher priced models is announced by Independent Pneumatic Tool Co. Saw includes long shaft transverse motor mounting for extra power and longer life; die cast aluminum housings; steel inserts to maintain critical parts in permanent alignment; built-in saw blower; steel rip guide with adjustments for any thickness or material being cut; finger-tip control for depth and bevel cuts and complete ball bearing construction.

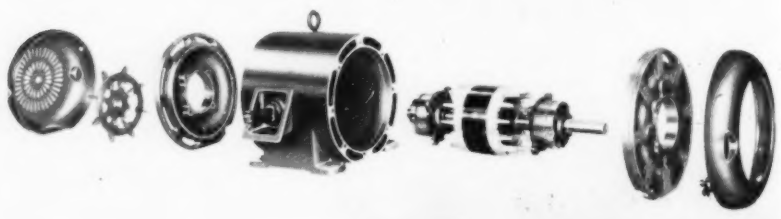
326—HEAT REMOVES PAINT QUICKLY

A gas burner that removes paint from metal faster and more thoroughly, has been announced by National Cylinder Gas Co. It also removes scale and rust and dehydrates the metal surface, leaving a clean surface for repainting. The burner uses a new principle in which an oxy-acetylene flame is supplemented by a low-velocity flow of pure oxygen, resulting in rapid oxidation of the heated paint.

The burner is designed to be attached to NCG's Torchweld "75" hand cutting torch

321—CAST IRON MOTOR COMBATS CORROSION

Wagner Electric Corp. has announced the development of a full line of cast iron frame totally enclosed fan-cooled motors, which are available in ratings from 5 through 250 hp in both standard (type EP) and explosion-proof (type JP) designs. These cast iron frame motors are especially suitable for applications in chemical plants, oil fields, petroleum refineries and similar industrial plants where corrosion is a problem, either because of the nature of the materials processed or because of outdoor use.



and the entire unit is light and easily handled. Replaceable wear-resistant guide shoes maintain correct distancing of the burner from the metal surface.

327—PNEUMATIC POSITIONER HAS ADDITIONAL POWER

A piston-type, pneumatic positioner providing long-stroke and surplus power is announced by Minneapolis-Honeywell Regulator Co.

The positioner, known as the Grad-U-Motor air piston, has been successfully field tested for damper positioning on diesel engine air-cooling systems and damper positioning on pneumatic temperature and pressure control systems.

Limitations overcome by the Grad-U-Motor air piston, compared with diaphragm type operators, include confinement of stem travel to about three inches.

328—FINISH AND SHEATH IMPROVE CABLE

Two changes have been announced by National Electric Products Corp. in the design of its canvas-back loomwire, a non-metallic sheathed cable. The No. 14 and No. 12 cable, with type T or type R conductor insulation,

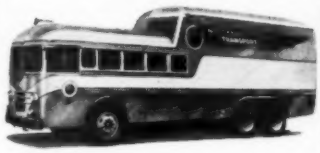
now have a finish that is smooth and hard, can not flake or rub off, and can be stored in warm locations without becoming tacky.

Stripping is improved by a paper dam under the sheath. This assures the conductor assembly remaining clean at all times; the markings always being sharp and distinct.

329—TURBINE PUMPS FEATURE EFFICIENCY

Completely new line of vertical turbine pumps has been developed by Worthington Pump & Machinery Corp. in capacities from 50 to 15,000 gpm. They develop maximum performance per size, and overlapping coverage allows selection for nearly any capacity and head condition at peak efficiency. Incorporated in the line are extra size bearings of special materials for long life, shaft seals where required, enclosed impellers

(Continued on page 124)



THE NORTHERN PACIFIC TRANSPORT COMPANY

. . . a very prominent western transportation company, operates a large number of motorized vehicles in the states of Montana and Washington. The operation of their equipment is extremely severe due to mountain grades and wide temperature variations.

They say . . . "THIS LUBRICANT CUT OUR PARTS REPLACEMENT 50%"

Quoting from their letter of October 17, 1949:

"We ran our first test on LUBRIPLATE #22 in March, 1945, in 3000 series Timken tandem-drive, worm axles. That year we experienced considerable trouble with wartime drivers and very poor roads, causing us no end of trouble. The oil that we were using set up to tar in 10 to 15 thousand miles. The LUBRIPLATE #22 proved so satisfactory we installed it in all our worm-gear, hypoid, and two speed axles. This enabled us to change our oil-change period from 15,000 miles to 40,000 and on some applications, depending on speeds and temperatures encountered, we raised the change period to 60,000 miles, or approximately once a year. Our overhaul periods were stretched from 50,000 to 100,000 miles, and repair parts bill cut 50% with the increased mileage."

Naturally with the economies that this company enjoyed through the use of LUBRIPLATE Lubricants on worm-axles, they extended the use of LUBRIPLATE to other parts of their equipment. The savings in parts, time, money and increased efficiency are equally startling. Let us send you the entire report of where they are now using LUBRIPLATE and what it is saving them.

LUBRIPLATE Lubricants will prove just as effective for you in your plant in reducing friction and wear. They are different from any other lubricants you have ever used. They save power, prevent rust and corrosion and definitely arrest progressive wear.

LUBRIPLATE Lubricants are available from the lightest fluids to the heaviest density greases. There is a LUBRIPLATE Product best for your every lubrication requirement. Let us send you CASE HISTORIES of savings that others in your industry are making through the use of LUBRIPLATE Lubricants. Write today.

LUBRIPLATE DIVISION
Fiske Brothers Refining Company
Newark 5, N. J. Toledo 5, Ohio

DEALERS EVERYWHERE . . . CONSULT YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE *THE MODERN LUBRICANT*

Unloaded... Installed... Operating... *in only 48 hours*

Recently a large steel corporation in Kansas City, Mo., ordered this nine-frame, 600 volt I-T-E secondary distribution switchboard as part of a modernization program to replace obsolete distribution equipment and provide additional interrupting capacity.

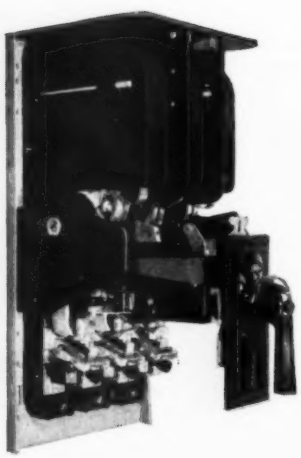
A quick changeover was essential . . .

Shortly after the switchboard arrived at a Kansas City freight yard, it was unloaded from the flat car and transferred by truck to the switchhouse, positioned relative to points of cable entry, main connections were made, and the power switch thrown—*all within 48 hours!*

This switchboard was installed easily, quickly and economically because it was *completely assembled* and *thoroughly tested* at the I-T-E factory prior to shipment. I-T-E engineered the job, supplied all components, installed all internal wiring, shipped the board as a complete unit. Only external cable connections were required after installation.

Here's proof that *you* can modernize *your* plant easily, quickly and economically. And there are many other benefits you get with I-T-E Low Voltage Switchgear. Here are a few:

- ***CAREFUL APPLICATION:*** I-T-E application engineers carefully apply the equipment to your needs and see that it is built to fit your requirements. All components that go into I-T-E switchboards are the finest obtainable, carefully coordinated into efficient functional units.
- ***ATTRACTIVE APPEARANCE:*** When you purchase other equipment you select it partly for appearance because you know how important it is to the efficiency of your personnel. Your plant personnel will react just as favorably to more attractive switchgear.
- ***DEPENDABLE CIRCUIT BREAKERS:*** No switchboard can be more dependable than the circuit breakers in it. I-T-E circuit breakers offer you the trouble-free protection so important to proper plant operation.



◀ ***Positive-acting Air Circuit Breakers***

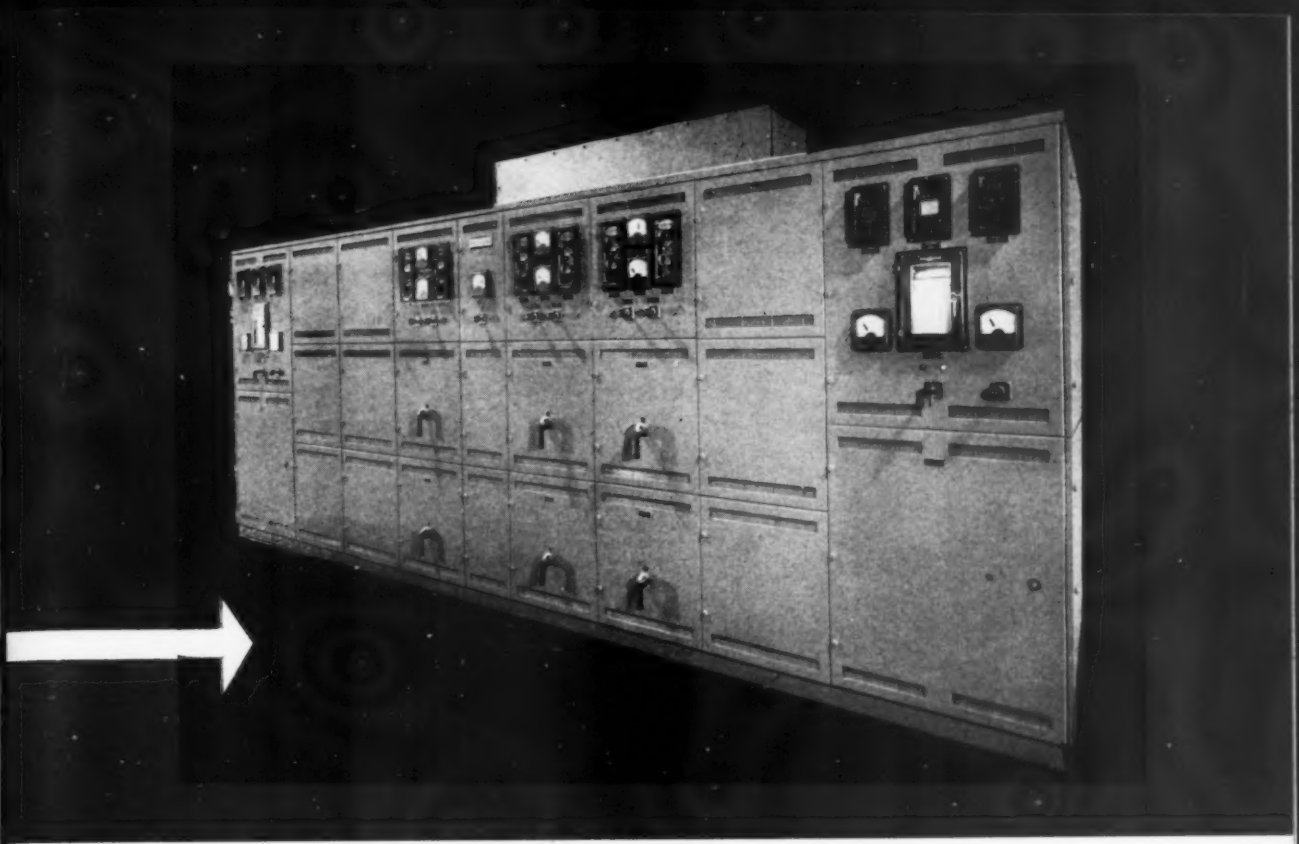
Type KB Breaker. 25,000 RMS Amp. Interrupting Rating. 600 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or Electrically operated.

Send for these descriptive bulletins: ▶

BULLETIN 6003-D: A complete reference guide to I-T-E 600 V. Switchgear Assemblies.

BULLETIN 7000-A: Describes I-T-E's newest 5 KV Switchgear.

Get both bulletins—ask your local I-T-E Representative, or write I-T-E General Offices.

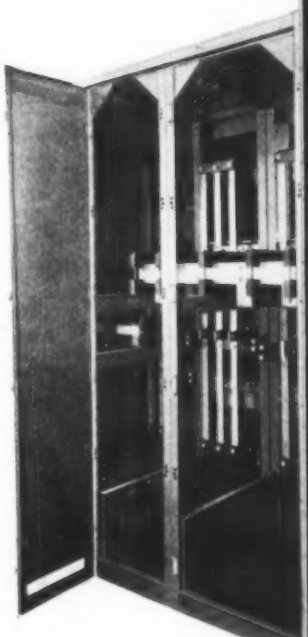


MULTUMITE SWITCHGEAR IS COMPACT . . . EFFICIENT!

The compactness of I-T-E Multumite assemblies is well illustrated in the above photo. Behind the attractive exterior of this switchboard are strong, efficient breakers and components—designed and built to provide positive protection of secondary distribution systems.

Electrically welded steel frames—one for each vertical group of breakers—are bolted together on a continuous channel-iron sill (furnished by I-T-E) to make a strong, rigid, and self-supporting structure. In addition to keeping the switchboard rigid in transit, the sill provides an excellent vermin-proof base for installation.

For extra protection of equipment, each breaker is in a separate metal compartment formed by horizontal and vertical steel barriers welded to the frame, exterior metal panels, and the metal back of breaker itself.



This bus compartment is designed for easy access ▶

Here's another reason installation of I-T-E Low Voltage Switchgear is so easy. A spacious bus compartment with a single horizontal bus facilitates cable connections, makes them easy to get to, provides more space for outgoing cables. Full-height hinged doors swing wide, can be removed easily. The whole compartment is *planned* for maximum accessibility and greater convenience!

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

R&IE

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

new bulletins and catalogs

Be sure to order your free copy of these booklets—they're the latest information published by leading manufacturers. Use the postage-free order cards on Page 37. Just list the Key Letters of the bulletins you want in the spaces provided on cards.

BOILERS, AUXILIARIES, ACCESSORIES

Oil Burners (A). Features of high-pressure venturi atomizing oil burners are thoroughly discussed in this 8-page illustrated bulletin. Also contained are specifications with capacity and pressure tables for the many types fabricated. Hauck Mfg. Co.

Spreader Stokers (B). Attractive two color folder shows by photographs and drawings the operating features of these automatic stokers. Describes how the stokers meet firing requirements for each particular installation up to 1000 hp. It also contains diagrams of typical installations. The Standard Stoker Co., Inc.

Refractory Mortar (C). The Composition, properties and applications of this chrome bonding cement, for use with all types of refractories, is clearly explained in 4-page brochure. E. J. Lavino & Co., Refractories Div.

Boiler Return Systems (D). Sixteen page three-color catalog illustrates and describes standard and special type of boiler-return systems. Applications, descriptive data and specifications are included, as well as: "What to look for when buying a return system." Fred H. Schaub Engineering Co.

Refractories (E). Intermediate and high-heat-duty fire brick is the subject of a bulletin just released. Properties are detailed and general characteristics and uses are specified. Information on the facilities for the production of special fire clay shapes to meet practically every requirement is included. Walsh Refractories Corp.

Stokers (F). Folder describes and illustrates various stoker models adaptable to any type or make of boiler or steam generator including package types. Gives typical 24-hr flow chart and sketches of installations. Detroit Stoker Co.

Economizers (G). New 6-page catalog covers cast-iron and steel tube economizers. The advantages of diamond shaped tubes and the streamlined flow of gas and soot-blower steam are discussed. Tube arrangement makes the entire outside surface of each tube visible during inspection. Green Fuel Economizer Co.

Refractory Concrete (H). Revised booklet on refractory and heat-resistant concrete gives latest available information on "how-to-do-it." You can select proper types of refractory concrete for a wide range of temperature and insulating conditions from the tables contained in this 24-page publication. Lumnite Div. Universal Atlas Cement Co.

Surface Condensers (I). With chapters on condenser design, installation of condenser tubes and construction of various types and sizes, this bulletin is well illustrated by cross sections, photographs and drawings on surface condensers and auxiliaries. Circulating pumps, vertical turbine pumps, steam-jet ejectors, and thermostatic control are also carefully treated. Worthington Pump and Machinery Corp.

Refractory Coating (J). Instructive 4-page bulletin describes a new method of coating refractories with a ceramic-metallic compound for protection against slag penetration, abrasive wear, flame erosion, corrosive gases, molten metal and thermal shock. Contains sketches of test methods and will answer most questions regarding this new method. Cera-Kote, Inc.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Turbines (K). Illustrated with photographs and drawings, this 12-page bulletin on multistage turbines gives data on casing, laging, blades, nozzles, wheels, shafts, diaphragms, bearings, interstage and end glands, governors, synchronizers, governor valves, steam strainers, nozzle control valves, sliding feet, auxiliary oil pumps and lubrication. The Terry Steam Turbine Co.

Hydraulic Turbine (L). Profusely illustrated with photographs and detailed cross-section drawings of typical installations, this 56-page bulletin describes the design and construction of Francis, propeller and impulse hydraulic turbines. It also describes such auxiliaries as pressure regulators, special high-head valves, butterfly valves and cabinet type governors for large units. Allis-Chalmers Mfg. Co.

Dual-Fuel Diesel (M). Illustrated 8-page bulletin describes various power applications of this four-cycle, 16-in. engine that operates on gas fuel with pilot oil, on oil fuel or on proportions of either. Engine can also be adapted to burn sewage gas. Shows by a schematic sketch and simple directions, the operation of the engine and the ease of immediate changeover in fuel. Nordberg Manufacturing Co.

Stationary Engines (N). Folder on dual-fuel engines describes latest improvements on these emergency power sources. Tells in simple words how to operate these engines that burn natural gas or diesel fuel. Murphy Diesel Co.

WATER AND LIQUID TREATMENT

Fuel-Oil Treatment (O). Folder describes the homogenizing fuel-oil treatment that disperses sludge and water, holding it in suspension for atomization and maximum burnability in all grades of fuel oil. Shows the benefits, economy and money saving attributes of this non-toxic, non-corrosive, non-explosive liquid fuel-oil treatment. American Sand-Banum Co., Inc.

Scale Prevention (P.) Folder cites typical applications of "threshold treatment" to prevent lime scale deposition in boiler feedwater lines, water heating, recirculating, cooling systems, multiple-effect evaporators, and after-precipitation following lime-soda softening. Calgon Inc.

Embrittlement (Q). Highly informative bulletin titled "Embrittlement—Current Status ... its causes and control" is a 3-page discussion on the problem of embrittlement. Tells how to distinguish between steam boiler cracks caused by corrosion-fatigue and embrittlement; explains the prevailing conditions that cause intercrystalline cracking of boiler metal, and describes recent developments including the use of the embrittlement detector unit. Allis-Chalmers Mfg. Co.

Fuel-Oil and Sludge Treatment (R). Illustrated folder and 7-page bulletin contain information for preventing and correcting unsatisfactory conditions in the storing, handling, pumping, heating and burning of industrial fuel oil. Sludge prevention is a major topic of these publications which also contain drawings, graph of a 50-day test and photo of testing equipment. E. F. Drew and Co., Inc.

Corrosion Control (S). Folder entitled "Calgon Controls Corrosion" describes and illustrates the protection of industrial, commercial and municipal water systems against general corrosive attack. Controlling corrosion of hot water systems and industrial cooling

systems is discussed, as well as the elimination of "red water." Calgon Inc.

Feedwater Treatment (T). Two-color bulletin contain 20 pages of descriptive data on zeolite and chemical type water softeners, demineralizing equipment and silica removal equipment. Another bulletin comprises five types of total demineralizing, three of partial demineralizing and various types of degasifying apparatus. Considerable information on silica removal by ion exchange is included. Hungerford & Terry, Inc.

Water Conditioner (U). Bulletin describes a two-stage softener in which the first stage is the hot process, using lime or dolomitic lime, followed by the zeolite softener, which reduces the residual hardness to zero. Cochrane Corp.

ELECTRICAL EQUIPMENT

Transformers (V). Design and construction features of power and distribution transformers — both large and small and secondary network—are described and illustrated in a 16-page bulletin. Also discusses step regulators, pole-type regulators, unit substations of all types, and instrument transformers. Allis-Chalmers Mfg. Co.

Induction Motors (W). A wide choice of induction motors and generators for instrumentation and control work is provided by 15 units including 5 new types, described in a 16-page booklet. Also contains specifications, typical performance curves and outline drawings. Arma Corporation.

Magnet Wire (X). 32-page booklet combines the listing of both film-type and asbestos and glass-insulated magnet wire. The properties, applications, advantages and available size are fully covered. Booklet also contains considerable test data, graphs, illustrations and pertinent specification tables. Installation details are clearly described. General Electric Co.

Variable Transformers (Y). Features of redesigned variable transformers are illustrated in 4-page bulletin. Rating chart, together with circuit drawings permit easy selection of the transformer best suited to a particular requirement. The Superior Electric Co.

Rectifier (Z). Literature describes a new product developed "to meet the demand for a single instrument that provides stabilized and regulated variable d-c voltage from a-c power lines." Ratings, outline dimensions, stabilization and regulation data are also included. The Superior Electric Co.

Lighting (2A). "Your Lighting Simplified" is the title of a new 10-page booklet that explains all about lighting layout, installation, equipment and maintenance. The Edwin F. Guth Co.

Electrical Enclosures (2B). Profusely illustrated 16-page booklet tells a picture story of the many items fabricated

(Continued on page 24)

NEW!
LOW PRICE M·R PUMP
NOW!
CAPACITY UP TO 6,000 SQ. FT. E.D.R.
20 LBS. DISCHARGE PRESSURE • 9 G.P.M.
SINGLE AND DUPLEX UNITS
TYPE V·V VACUUM PUMP
TYPE E CONDENSATION PUMP
TYPES B AND C
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Here's the foremost Pump Value, *in high quality features at a low price.* This MR Pump has hand-finished water passages, to minimize friction; impeller is rigidly and concentrically fixed on stainless steel shaft for perfect balance and vibrationless performance; pump casing equipped with bronze wearing ring—*a long-life feature seldom found in low-priced pumps;* prelubricated bearings; spring loaded bronze seal; motor and impeller assembly can be lifted by removing three bolts—*and without disconnecting any piping.* Write now for Bulletin CP-949.
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120 NORDBERG provide reliable uninterrupted power in the WORLD'S LARGEST INTERNAL COMBUSTION ENGINE PLANT

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NORDBERG *Gas Burning Radials* at Alcoa's Point Comfort Reduction Works provide nearly 200,000 Horsepower 24 HOURS A DAY—365 DAYS A YEAR to meet the full capacity demand

Important features of NORDBERG *Radial* ENGINES

- LOWER INVESTMENT COST
- LOWER INSTALLATION COST
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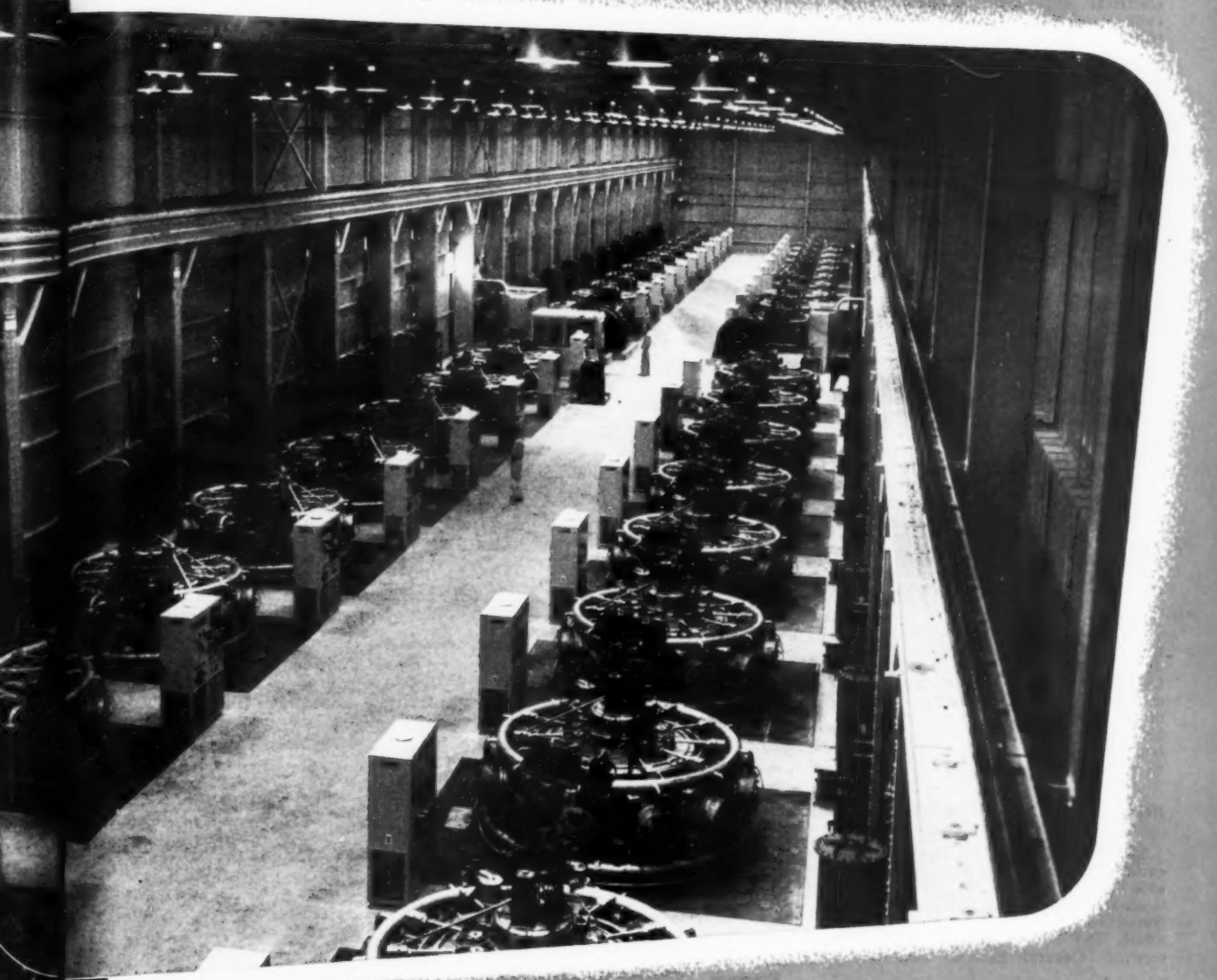
- AVAILABLE THREE WAYS . . . as oil burning Diesels, as natural gas engines, or as Duafuel engines.

Applicable for industrial and municipal power plants and central stations or wherever compact, economical, dependable power is required. *For full details covering Nordberg Radials, send for BULLETIN 172.*

Radial ENGINES



IN planning the Point Comfort (Texas) Reduction Works, Aluminum Company engineers were confronted with the tremendous task of providing sufficient electric generating capacity to produce over 100,000,000 pounds of aluminum per year. By specifying 120 Nordberg two-cycle Radial Engine Generating Units as the solution to this huge power problem, Alcoa took advantage of these important economy factors:

(1) *Reduced investment cost . . . engine-generating unit cost . . . installation cost (building size is 50% of usual requirements).*

(2) *Reduced operating cost . . . fuel cost . . . maintenance cost.*

(3) *The experience offered by Nordberg as the producer of America's largest line of heavy duty internal combustion engines.*

This tremendous installation exemplifies the way in which Nordberg Diesel Engines, in sizes from 10 to 9600 hp., are used to provide dependable, economical power for stationary and marine requirements all over the world.

NORDBERG MFG. CO., Milwaukee, Wis.

MSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

(Continued from page 21)

by this manufacturer of sheet metal electrical enclosures. Control desks, cubicles, electrical cabinets, power distribution and control panels, switchgear housings and many other large and small items are pictorially presented. The Kirk & Blum Manufacturing Co.

Outdoor Bus Ducts (2C). "To Whom It May Concern" letter written to this company's field engineers tells about outdoor bus duct that has received Underwriters Laboratories approval. BullDog Electric Products Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Underfloor System (2D). Manufacturer of steel underfloor electrical raceway systems has published a 36-page four-color catalog which provides, among other things, a complete suggested specification for a floor electrical distribution system. Other pages are devoted to drawings, specifications and photos of the component parts of the system. Roughing-in dimensions are provided, as are material catalog numbers. National Electric Products Corp.

Polyphase Motors (2E). Bulletin (10-pages) on polyphase electric motors, describes one to 75-hp horizontal motors, illustrating construction details in cross section and cutaway views. Some of the features described are insulation, bearings, ventilation, mounting, service, frames and end bells, rotors and machining. A. O. Smith Corp., Motor Div.

INSTRUMENTS, CONTROLS, RECORDERS

Electronic Timer (2F). Design, application and construction details together with installation and operating instructions are clearly shown in 4-page illustrated bulletin on compact electronic timer. The device provides automatic control. General Electric Co.

Flow Instruments (2G). Complete new 28-page illustrated catalog discusses basic devices for coupling a primary metering element to a secondary or exhibiting instrument, as well as magnetic clutch and electrical impedance-bridge transmitting systems. Instruments illustrated and described are flow indicators, recorders, integrators and a new pneumatic controller unit. Fischer & Porter Co.

High-Range Insulation Tester (2H) Complete information on a new high-range insulation tester is available in a 24-page bulletin. Higher and wider ranges—up to 50,000 megohms, 2,500 v d-c—of this new instrument are discussed together with typical cases of its application in the field of preventive maintenance. James G. Biddle Co.

Portable Insulation Tester (2J). Literature on a new small, portable hand crank insulation tester gives a complete description of this 4-lb 14-oz instrument. In addition, it contains specifications and a schematic diagram of the tester. Herman H. Sticht Co., Inc.

Counting and Timing (2K). Bulletin (4 pages) describes a mechanical recorder which may be actuated by nearly any operation, from punch press to nuclear reaction, that may be provided with an electrical impulse. Units as low as 1/100 min and intervals up to 1,000 min are handled. Complete specifications and some applications are given. Streeter-Amet Co.

Temperature Regulator (2L). Self-operating regulator, combining valve and thermostatic bulb in one unit is described in 7-page bulletin, with engineering information on applications, pressure drops, capacities and temperature ranges to 450 F. Useful in most cases where temperature controlled liquids are used. Powers Regulator Co.

Engine Indicator (2M). Instrument for recording the complete pressure-time diagram of even high speed engines is described in leaflet. Portability and wide range of the instrument permit a convenient study of the pressure events under consideration. Bacharach Industrial Instrument Co.

Flowmeters (2N). Data Booklet, 32 pages, fully illustrates and explains flow measurement problems and their solution. Meter bodies, differential devices and reading instruments are described and a special section is included on a wide range and reverse flow. Republic Flow Meters Co.

Recording Thermometers (2P). Liquid-filled, vapor pressure, and gas-filled thermometers for recording, indicating, controlling and telemetering are the subject of a new 44-page, descriptive and illustrative bulletin. Information on operating principles, characteristics of operation, temperature sensitive bulbs, recording charts and accessories is given, in addition to reproductions of actual temperature chart records and sketches of applications. The Bristol Co.

Pressure Differential Meter (2Q). Bulletin (4 pages) describes instrument for reading pressure differentials from 50 in. water to 150 psi at pressures up to 2,500 psi. Applications for measuring pressure drop in steam, gas and liquid flow are discussed and diagrams fully illustrate operating principles. Hagan Corp.

MATERIAL HANDLING

Electric Hoists (2R). New line of heavy-duty electric cable hoists with capacities to 5 ton is fully covered in an attractive, three-color illustrated, 8-page folder. Photos, diagrams and line drawings, as well as specifications and prices are included. The Ohio Electric Mfg. Co.

Outdoor Fork Truck (2S). Gas truck for outdoor use is thoroughly described in 4-page bulletin that also contains capacity chart, dimensional drawings, specification details and illustrations of outstanding features. The Yale & Towne Mfg. Co.

Magnetic Separator (2T). New 8-page catalog presents the application, operation and design of drum-type magnetic separators. Information on correct selection for a given application together with data on capacities and dimensions is included. Typical diagrams are shown with recommendations. Dings Magnetic Separator Co.

Electric Hoists (2U). Colorful 8-page bulletin describes construction of hoists and includes specifications on capacities, power, hoisting speeds and dimensions. Accessory items are also included. Whiting Corp.

Conveyors (2V). Booklet (18 pages) interestingly illustrated with photographs and diagrams, gives the current solutions to conveyor problems in many industries. Accessory items such as bin dischargers, mixers and car spotters are also included. Stephens-Adamson Mfg. Co.

Belt Conveyors (2W). Forty pages of engineering information include data, illustrations and descriptions of types, drives, capacities and applications. Charts permit the engineer to analyze his conveyor problems and lay out the specifications. Barber-Greene Co.

POWER TRANSMISSION

Speed Controls (2X). Infinitely variable speed drives with automatic controls of the electronic, mechanical, pneumatic or hydraulic type are described in a colorful 8-page bulletin. Capacities are from 1 to 25 hp. Diagrams illustrate many applications. Link-Belt Co.

Gearmotors (2Y). Folder lists specifications including speed, torque, capacity and dimensions of a new line of gearmotors rated up to 5 hp with speed reductions as high as 37 to 1. Abart Gear and Machine Co.

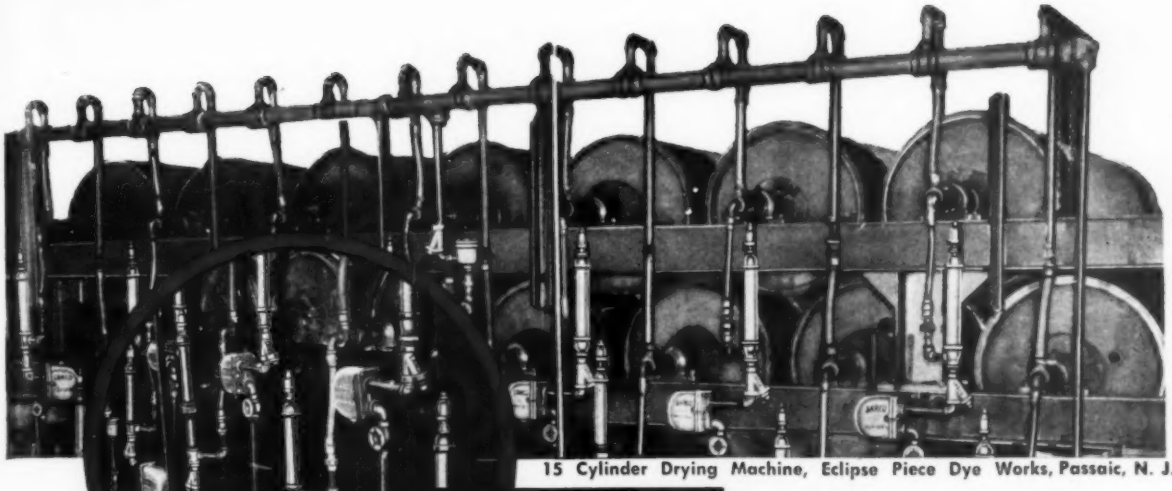
Mercury Clutches (2Z). Bulletin describes the mercury clutch and lists various applications from lathes to air conditioners. Illustrated, 7 pages. Another bulletin of 4 pages covers electric motor installations. Automatic Steel Products Inc.

PUMPS AND ACCESSORIES

Rotary Pump (3A). New general service, screw-type rotary pump, with capacities to 85 gpm and pressures to 150 psi, is described and illustrated in 8-page bulletin. Contains cross-sectional drawing, viscosity tables, dimension drawings and table of a standard NEMA motor frame sizes. IMO-DeLaval Products Div. DeLaval Steam Turbine Co.

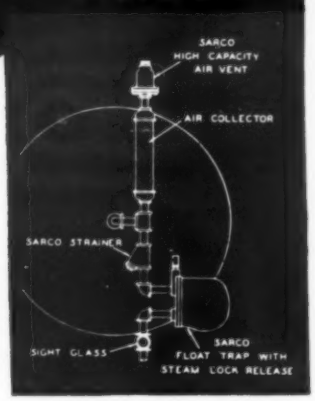
Centrifugal Pumps (3B). New Engineering approach is described in 3-page bulletin on vertical, double-case pumps for capacities up to 450 gpm (increased by manifolding), pressures to

(Continued on page 120)



15 Cylinder Drying Machine, Eclipse Piece Dye Works, Passaic, N. J.

SARCO INCREASED CLOTH DRYING PRODUCTION 10 *to* 15%



The Sarco System is a packaged unit—ready to install and made up of time tested, Sarco elements which have given satisfactory service for years.

An investment of less than 1% of the original cost of this 15 cylinder drying machine increased its production 10 to 15% — with the Sarco Drainage System. Because all condensate and air are removed continuously, all parts of every cylinder are always hot. No air binding — no water logging — no steam locking; and you get a dollar's worth of usable heat from every dollar's worth of fuel you buy.

Warm-up time is also greatly reduced. In one plant, 2½ hours are saved every time the machine is started up — in this case a dozen times a week.

This is only one of the ways Sarco Saves in textile plants. Elimination of condensate and air, and temperature controls are working wonders. For instance, Sarco experience in using hot condensate for other purposes may save thousands of dollars in your plant.

Sarco products also include self-operated and electric controls for all wet process operations. Write for the catalogs.

302

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IMPROVES PRODUCT QUALITY AND OUTPUT

readers' guide to advertised products

Here you'll find, briefly reviewed, all the booklets and leaflets offered in the advertising columns of this issue of INDUSTRY AND POWER. For easy reference, this listing is divided into various classifications of products. To get your free copies of literature described here and in the corresponding advertisements, turn to Page 37 for a postage-free order card. There, list the Key Numbers of the paragraphs below and mail.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 139. Packaged Steam Boilers: Send coupon for full information on complete line of packaged steam boilers—fully automatic, 60 to 500 hp plus ample overload. Johnston Brothers, Inc.

2—See page 64. Unit Steam Generators: Bulletin 1000 gives you complete details on these cost cutting, Preferred Unit Steam Generators. They offer fully automatic operation with inexpensive No. 6 oil—but assure even more than appreciable, immediate returns on your investment. Designed to give continuing economical operation for at least 25 years. Preferred Utilities Mfg. Corp.

3—See page 56. Steam Generating Units: Send today for bulletin showing typical installations of these steam generating units for power, processing loads, and heating. Design provides large furnace volume and high ratio of radiant heating surface—proper combustion assured with any fuel or method of firing. Henry Vogt Machine Co.

4—See page 143. Boilers: Wickes can fill your exact requirements for boilers of any type with fast, extra efficient service. Be sure to write for information. Wickes Engineers appreciate importance of hurrying up your boiler specifications, drawings, fabrication, installation and service. The Wickes Boiler Co.

5—See page 116. Automatic Packaged Unit Boilers: Oil or gas fired, these boilers are self-contained—shipped complete with all equipment necessary for low cost installation. Write today for Catalog. The Dutton Boiler Division, Hapman-Dutton Co.

6—See pages 58, 59. Pulverizers: Tungsten carbide facings on pulverizer parts give you much longer life, greatly reduce maintenance costs, insure sustained fineness of pulverization. Write today for further information. Riley Stoker Corporation.

7—See page 34. Packaged Steam Generators: New fully illustrated Catalog 202 gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

8—See page 141. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

CLEANERS AND BLOWERS

9—See page 139. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

COMPRESSORS

10—See page 61. Compressors for Oil-Free Air: Requiring no oil, grease, or other cylinder lubricant, these compressors are ideal where compressed air or gas must be free from oil. Write for Bulletin 728-8. Chicago Pneumatic Tool Co.

11—See page 131. Air Compressor: There's a Schramm Air Compressor to fit your every need—providing air where you want it, economically and continuously. Compact, light-weight, truly versatile—vibrationless! Write today for full details. Schramm Inc.

DIESEL POWER

12—See page 55. Superior Diesels: Be sure to read the remarkable success story on page 55 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated 20-page booklet. The National Supply Company.

13—See pages 22, 23. Radial Engines: Bulletin No. 172 covers full details of Nordberg Radials—lower investment cost, lower installation cost, lower operating and maintenance cost, less space required—available in three ways—as oil burning Diesels, natural gas engines, or Duafuel engines. Nordberg Diesel engines in sizes from 10 to 9600 hp. provide dependable, economical power for stationary and marine requirements world over. Write today. Nordberg Mfg. Co.

DUST & FLY ASH COLLECTING EQUIPMENT

14—See page 121. Dust Control: Write for information on how dust control equipment can create better working conditions that result in more production and lower costs. Dracco Corporation.

15—See page 7. Dust Control: Let Kirk & Blum experts design, fabricate and install a complete dust or fume control system for your plant. This service solves your problems for you—pays off in greater operating efficiency. Write for full information. Kirk & Blum Mfg. Co.

16—See page 13. Electric Precipitator: "SF" Electric Precipitator is newly designed for high efficiency recovery of ultra-fine dusts, fumes and vapors. Installation is custom engineered for the job it will do. Backed by realistic fractional efficiency guarantee. For full information write today. Buell Engineering Co.

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on page 37. Mail today—postage-free!

ELECTRICAL EQUIPMENT

17—See page 42. Renewable Fuses: You are invited to write for latest Catalog for more information about Economy "De-Lay" Renewable Fuses, which give safe protection where most overloads occur—in the 135 to 200% range. Economy Fuse and Mfg. Co.

18—See pages 18, 19. I-T-E Switchgear: If you have any questions on modern HV switchgear construction, send for Bulletin 7000-A on I-T-E's newest 5KV Switchgear. Also request Bulletin 6003-D, a complete reference guide to I-T-E 600V Switchgear assemblies. I-T-E Circuit Breaker Co.

19—See page 125. Magnetic Starters: Write today for literature on Arrow-Hart "RA" magnetic starters. High arc resistance, ease of wire and servicing, balanced mechanism cuts space in half. The Arrow-Hart & Hegeman Electric Company.

20—See page 128. Wire-Pulling Compound: New compound for maximum performance in pulling rubber covered, asphalt coated and other types of covered wire. Send for free sample and literature. Adam Cook's Sons.

FLOOR REPAIRS

21—See page 138. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or complete overlay. Used indoors or out. Dries fast. Send for free trial offer and "Handbook of Building Maintenance". No obligation. Flexrock Company.

FUELS AND FIRING EQUIPMENT

22—See pages 52, 53. Vane Control: Easy to operate, for link and lever action, no lubrication, full fan performance—Sturtevant Vane Control is the economical way to obtain variable fan outfit at high efficiency. Combines the adantages of instantaneous regulation to exact pressure and volume requirements with substantial power savings when system does not operate at full rated capacity. Write for full information. Westinghouse Electric Corporation, Sturtevant Division.

23—See page 127. Automatic Spreader Stoker: Write for new bulletin, Publication No. 85, for complete information on Chicago Automatic Stokers—meets over-all firing requirements for wide range of steam demands. Bulletin includes typical layouts. Standard Stoker, Inc.

HEATING, VENTILATING AND AIR CONDITIONING

24—See page 15. Unit Heaters: Catalog 16C-1 describes Fedders Series 16 Downblow Unit Heaters. Catalog 15C-4 gives you complete details on Fedders Series 15 Horizontal Unit Heaters. Send for your copies today. Fedders-Quigan Corp.

25—See page 43. Tankless Water Heaters: Provide independent hot water supply for washrooms or process units. No tank to install. Use as booster to your present

(Continued on page 27)

reader's guide to advertised products

(Continued from page 26)

tank-type system. Available in 19 sizes up to 300 gpm. Write for Catalog 19. General Fittings Co.

26—See page 114. Burners: Let skilled Todd specialists engineer your boiler plant for maximum economy—they'll help you modernize obsolete equipment or provide new, efficient installation of oil burners, gas burners or combination oil and gas burners. Write today for full information. Combustion Equipment Division, Todd Shipyards Corporation.

27—See page 142. Heating Specialists: Petro-Chem Development Company Engineers. They can supply the whys and wherefores of indirect versus direct heating and the economics of both. Every day more than 600 oil and gas fired Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation. Write for additional details. Petro-Chem Development Co., Inc.

INSTRUMENTS

28—See page 138. Dial Thermometers: Vapor pressure actuated. 4" dials with rigid stem or flexible tubing type. Get full details in Bulletin No. 355. The Powers Regulator Co.

29—See page 124. Boiler Feed Water Meters: Send for details on Henszey meters that provide dependable, accurate measurement of boiler feed water, boiler blowdown, condensate, chemicals, and other similar liquids. Henszey Co.

30—See page 136. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

31—See page 140. Ernstilt Adjustable Inclined Column: Send for Bulletin T-1 which contains specifications of the Ernstilt adjustable inclined column, specially designed for package type boilers up to 300 Pounds W. S. P. Full information, too, on Leakless Try Cocks. Write today. Ernst Water Column & Gage Co.

32—See page 117. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications—wide variety of types. Write for complete information. Weston Electrical Instrument Corp.

33—See page 4. Oxygen Recorder: Bulletin No. 49-829 gives you full details on principle and operation of Hays Oxygen Recorder and Analyzer. Be sure to write today. The Hays Corporation.

34—See page 130. Analyzer: Write today for Bulletin 900 outlining details on this CO_2 Analyzer—gives complete sensitive accurate analyses by thermal conductivity method. 0-5%, 0-10% and 0-20% types indicate range available. Thermal conductivity method combines simplicity of equipment with extreme accuracy. Charles Engelhard, Inc.

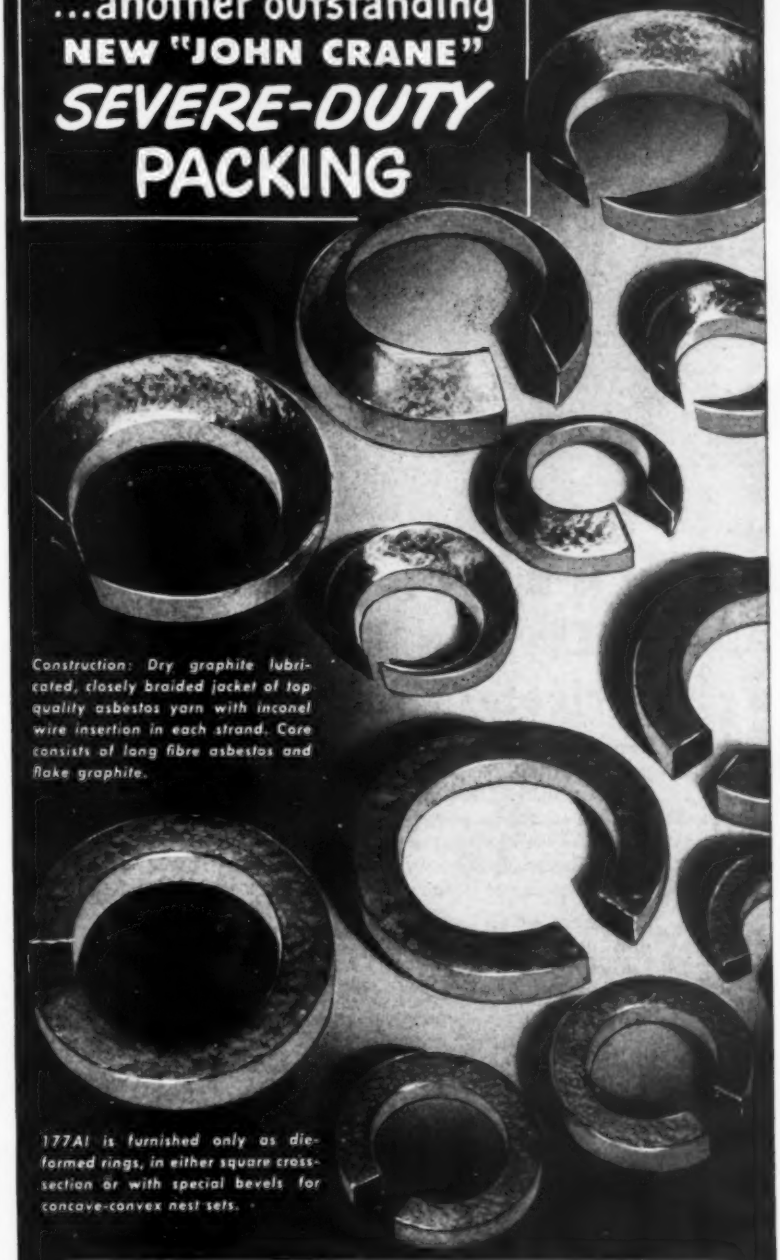
INSULATION

35—See page 65. Kaylo Insulating Material: Available in block or pipe covering form, this material is remarkably efficient throughout a wide 200°—1200° F. temperature range. Send for descriptive literature. Kaylo Division, Owens-Illinois Glass Co.

36—See page 140. Insulating Cement: Write for Bulletin I-75 for complete details on Stic-tite insulation. Cut fuel costs by covering fittings, valves, flanges, and surfaces with this long-lasting, easy-to-apply cement. Rtefractory & Insulation Corp.

(Continued on page 32)

...another outstanding
NEW "JOHN CRANE"
SEVERE-DUTY
PACKING



Construction: Dry graphite lubricated, closely braided jacket of top quality asbestos yarn with inconel wire insertion in each strand. Core consists of long fibre asbestos and flake graphite.

177AI is furnished only as die-formed rings, in either square cross-section or with special bevels for concave-convex nest sets.

177AI— *for* **EXTREME PRESSURES, TEMPERATURES** *to* **1200°F**

If you have a high temperature packing problem on steam valves, soot blowers, gauge glass fittings, etc., you need this new "John Crane" packing. It remains resilient at high temperatures, it will not harden, even at 1200°F, and it easily withstands pressures as high as 2000 psi.

Style 177AI is the newest in the extensive "John Crane" line of quality packings. If you don't have the complete "John Crane" catalog, you should write for it—its recommendations can be a real help.

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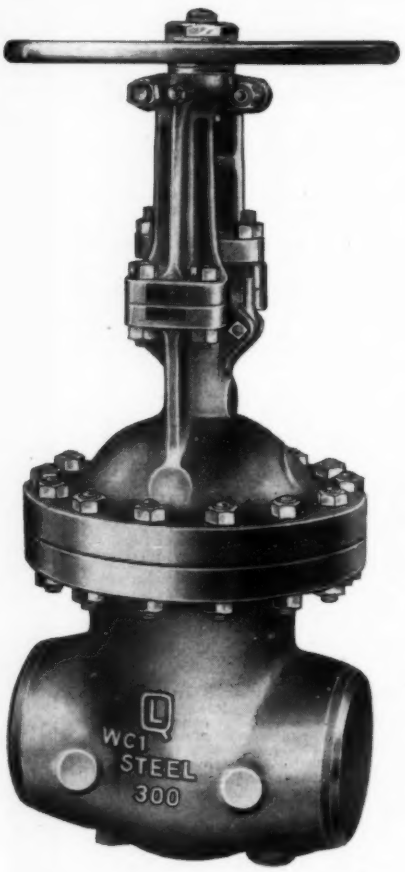
LUNKENHEIMER
. . . The Steel Valve With A Priceless Ingredient

Into every heat of Lunkenheimer molten steel goes one ingredient that no other valve foundry can duplicate. It's not measured in ounces or pounds — but in generations . . . of tradition. It is pride in the kind of workmanship that has made Lunkenheimer universally respected as the one *great* name in valves.

Engineers are accustomed to dealing in facts — not intangibles. But every realistic engineer knows that molten steel is tricky stuff to handle. It demands *more* from the workman than simple attention. Quality valves—safe valves—are not made by formula alone, but by care . . . interest . . . pride in an unbroken tradition of fine workmanship. At Lunkenheimer, that tradition goes back to 1862.

Lunkenheimer's priceless ingredient will always be intangible, but it can be expressed in terms of one interesting fact: ***there is no instance on record where a Lunkenheimer steel valve has ruptured due to defective metal.*** For more facts — and for information relating to your specific steel valve application — write immediately to The Lunkenheimer Co., P. O. Box 360B, Cincinnati 14, Ohio.



STEEL • IRON • BRONZE

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-760-138

CONTINUOUS-FLOW CONVEYER

WILBUR G. HUDSON, *Consulting Engineer*

THE continuous-flow-conveyer elevator has interesting possibilities and will run for years when it is suitably designed and applied. With skeletonized flights, it is the only scraper conveyer that can handle flowable material in a horizontal run-around path (two parallel runs with semi-circular end turns).

Generally speaking, it should not be selected for a straight horizontal, or nearly horizontal run because a screw conveyer will handle any material the continuous-flow unit can handle, and at a fraction of the first cost. It is an alternative to a flight conveyer, but has no advantage unless you want to convey the material without risk of contamination. Costs are about the same.

The continuous-flow machine, Fig. 1, will handle material on rising inclines steeper than the screw or flight conveyer can attempt advantageously. It is self-loading to capacity, cannot overload itself, and needs no feeder. If there are gravity feed points in succession the machine will automatically load itself to capacity from the first one, and the feed will shift along from point to point as the flow from each prior opening is exhausted.

The rectangular duct is readily insulated with strips of asbestos to reduce temperature changes in the material. Its speed is slow, usually 60 fpm or less. Operation is dustless: There is a certain amount of grinding of a granular material between the impellers and duct walls, but probably little more than in a screw or flight conveyer.

The continuous-flow conveyer is best suited to handle free-flowing granular or pulverized material not actively abrasive or corrosive. We may list materials in five groups progressively difficult to convey. The factor "C" in the following list is the resistance coefficient used with the power determination factors listed at the bottom of Fig. 2.

1. Easily handled, C=1: Bran, coffee, ground cocoa beans, flaxseed, graphite flakes, soap flakes, soy beans and ground copra.

2. Easily handled, but requiring slightly more power, C=1.2: Beans, ¾-in. slack or smaller coal, coffee beans, flour, soybean meal and wood chips (dry).

3. Suitable, but requiring more power, C=1.5: Talc, starch, pulverized salt, rock salt and wet wood chips, etc.

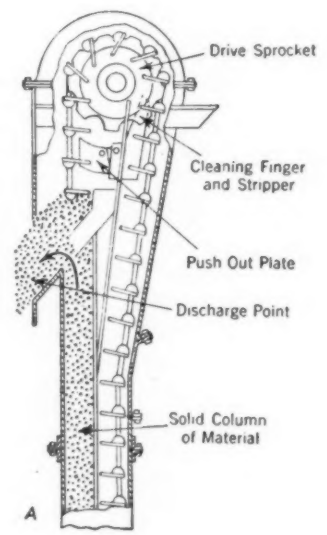
4. Usually not difficult, but requiring more power, C=2: Clay, flyash, lime (pebble), sugar, soda ash (light) and zinc oxide.

5. Duct should be of Corten steel or similar abrasion-resisting material, C=2.2 to 2.5: Alum, borax, ground cork, lime, soda ash (heavy), tobacco scraps and limestone, (pulverized).

Materials for which the machine should not be selected include ashes, cement, sand, gravel, crushed stone, molybdenum concentrates, wet sewage sludge, heavy metal dust, damp corrosive coal, and other corrosives. Fig. 2 shows the various conveyer paths, and their corresponding equations for determining the approximate motor horsepower.

If a decision has been made in favor of installing a continuous-flow machine we must determine the advantageous size and running speed, and whether the unit selected can tackle the job without overloading the pulling chain. Fig. 3 shows the range of duct areas available. At the right are listed the capacities in tons per hour for the various weights per cu ft of materials at the speeds noted at the bottom. Thus, for a capacity of 30 tph of material weighing 50 lb per cu ft, we have the choice of a machine with a 54-sq in. duct at 70 ft per min, a 66-sq in. duct at 57 ft per min, or an 80-sq in. duct at 46 ft per min, etc.

Handling rate usually approximates 80% of the volume swept through, an indication that there is some slip even with full loading. Under part loading, in a vertical run, the material slips



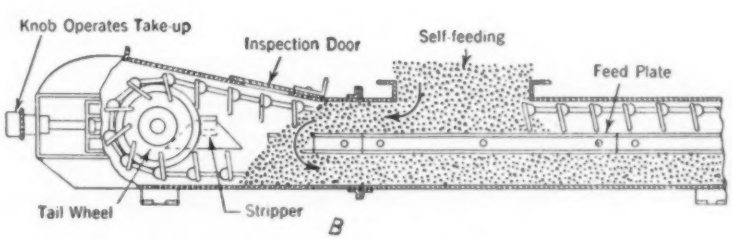
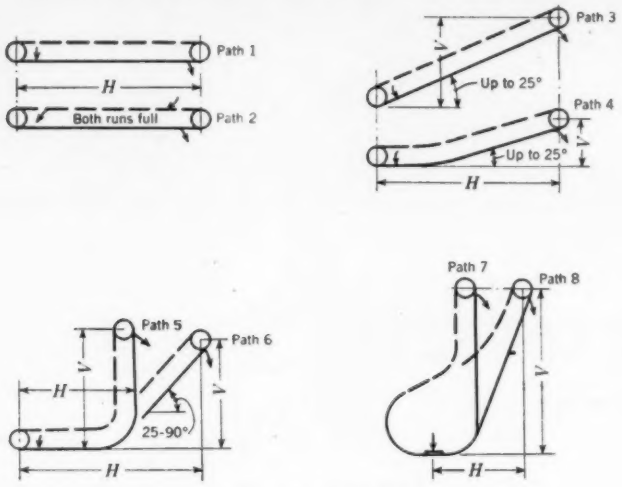


Fig. 1—Movement of material in a continuous-flow elevator (A) and conveyer (B). The machine is self-loading to capacity, cannot overload and needs no feeder

POWER EQUATIONS FOR CONTINUOUS-FLOW CONVEYERS AND ELEVATORS



Path 1. Motor hp. = t.p.h. × H × 0.002 × C
Path 2. Motor hp. = t.p.h. × H × 0.004 × C
Paths 3 and 4. Motor hp. = t.p.h. × (H × 0.002 + V × 0.001) × C
Paths 5 and 6. Motor hp. = t.p.h. × (H × 0.0032 + V × 0.003) × C
Path 7. Motor hp. = t.p.h. × (V + 3) × 0.003 × C
Path 8. Motor hp. = t.p.h. × (H × 0.002 + V × 0.003) × C

t.p.h. = tons per hour
C = material factor
H = horizontal distance
V = vertical distance

Fig. 2—Knowing the kind of material to be handled, conveyer path and duct area, these equations give driving horsepower required. Courtesy of Link-Belt Co.

downward to fill the compartments; that is, if we feed at 50% capacity, the discharge is, of course, the same, and there is an excessive slip. Where possible the speed should agree closely with the full load rated feed.

We must ascertain from the manufacturer the working limit of his chain. Suppose we want to handle 25 tph of heavy soda ash weighing 60 lb per cu ft with a standard loop-type machine on a lift of 47 ft. From Fig. 3 we select one with 43-sq in. duct area at 60 ft per min. From Fig. 2, path 7, motor size is 25(47+3) x 0.003 x 2.5= 9.4 hp. Horsepower at the head sprocket is about 8, and at 60 ft per min. the sprocket pull on the chain is 4400 lb. Weight of chain and flights in the down run adds to the chain pull but reduces the hp. The chain pull is about 4800 lb, which is beyond the rating of the chain in this size of machine. With gravity feed, increasing machine speed will not reduce chain pull because the conveyer will continue to load itself to capacity. We may specify the 43-sq in. machine with the next heavier chain having a rating of 5000 lb, or 25% higher if of special alloy. Motor horsepower for a competitive bucket elevator is tph x 2 x lift/1000 = 2.35 hp.

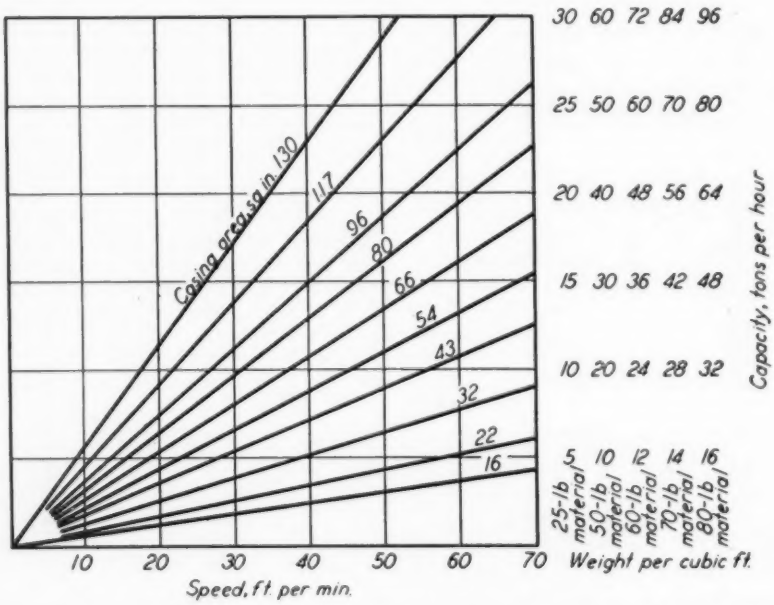


Fig. 3—Range of duct areas available with capacities in tons per hour for the various weights per cubic foot of materials and operating speeds of conveyers

Interlocking

Upon a power failure the continuous flow elevator reverses only a foot or so and a back-stop is not used, but an instantaneous release by shear pin in the drive is advisable. This releases the motor, but if a tandem conveyer is driven by another motor electrically interlocked with it, both motors continue and the tandem machine continues to pour its load into the stalled unit. A releasing device must be arranged to release all motors ahead of the one that sheared its pin.

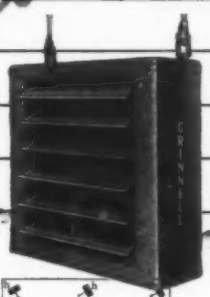
A bucket elevator coupled to a tributary machine readily takes care of brief surges by spilling material back into the boot. There is no leeway whatever in the continuous-flow machine and it is necessary to provide a surge hopper between the units with a diaphragm cutout that will stop the first unit for a few minutes whenever the surge hopper fills. If this repeats, the second machine should be speeded up.

The continuous-flow conveyer-elevator properly applied does a good job. It occupies less space than other types of conveyers, often reduces the number of units required, is slow in speed, and can be applied to a track hopper with a pit depth of three feet. Compared with the competitive feeder-elevator combination it assures a reduction in first cost from 25% to 50%. It requires more power, but that is a minor factor where the capacity is moderate.

ENGINEERING DATA

This department is devoted to engineering data that plant engineers can use in their design and installation work. If you have a curve, chart or other data you find useful, let us publish it. Rate of pay will be based on the engineering value of contributions, with a minimum of $15 for smaller-than-page items accepted.

Consider the advantages of UNIT HEATING



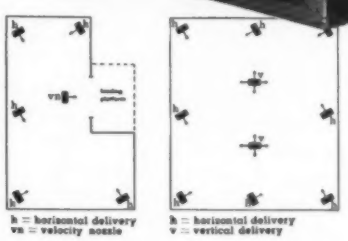
Heating comfort Unit heaters provide quick heating from a cold start. Desired temperatures are easily maintained within a close range. Heat is uniformly distributed in the working zone by forced air circulation. It is a very flexible system because different or changing heating requirements are easily satisfied by means of different models, a range of capacities, single- or two-speed motors and individual thermostatic controls.

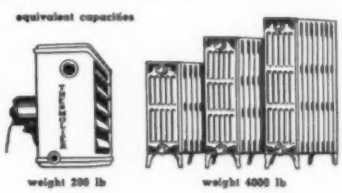
Low first cost Unit heaters are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost. Additional savings are effected because the system requires a proportionately smaller amount of pipe, fittings and accessories.

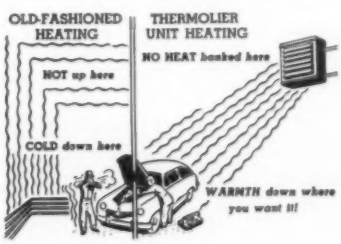
Economy of operation Heat is forced down to the working level . . . not banked uselessly at the ceiling level. Heat is turned on and off merely by throwing a switch either manually or automatically by simple thermostatic controls. The rapid response means that heat is furnished only when and where it is wanted . . . no heat is wasted.

Adaptability to equipment and floor layout Unit heating is widely used in industrial plants and warehouses, garages, stores and public buildings. The units and the simple piping are overhead where they do not interfere with arrangement of operating machinery or equipment and do not take up valuable floor or wall space. Units are easily relocated at any time to meet changes in layout.

Thermolier unit heaters have important construction advantages The design of Thermolier unit heaters is the product of Grinnell Company's ninety-nine years of heating experience. Those responsible for heating like Thermolier's durability, freedom from maintenance troubles and dependable operation. Typical of its construction features is the patented internal cooling leg which permits the use of a plain thermostatic trap, the simplest, least expensive kind of trap. Other features are built-in drainage, continuous rated capacity and provision for expansion of U-tubes.







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LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

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38—See page 17. Lubriplate Lubricants: Ask for facts and figures on the variety of oils and greases developed to give protective lubrication to your machinery even under conditions of moisture and acids. Fiske Brothers Refining Co.

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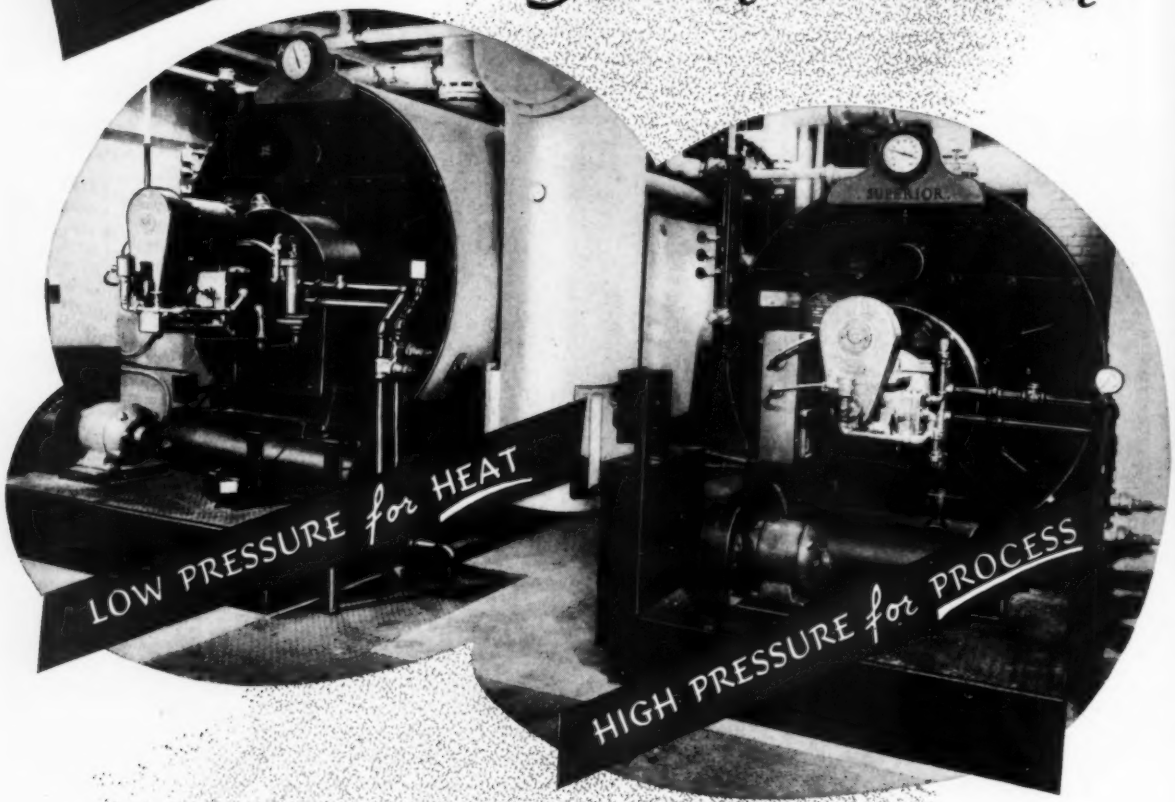

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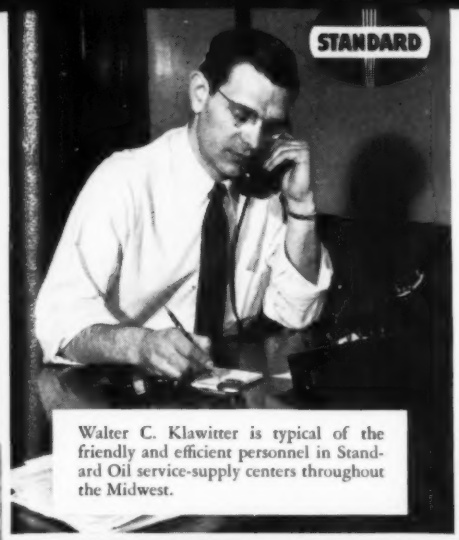

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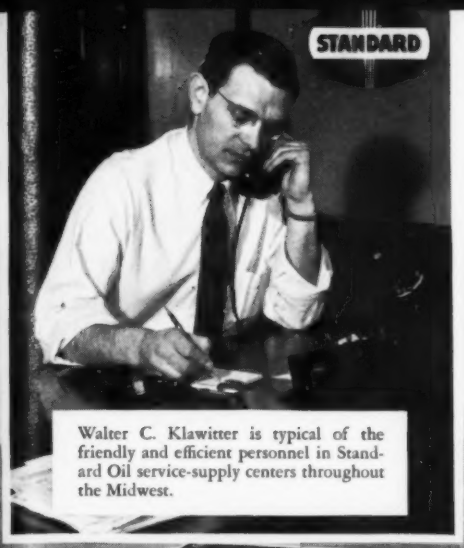

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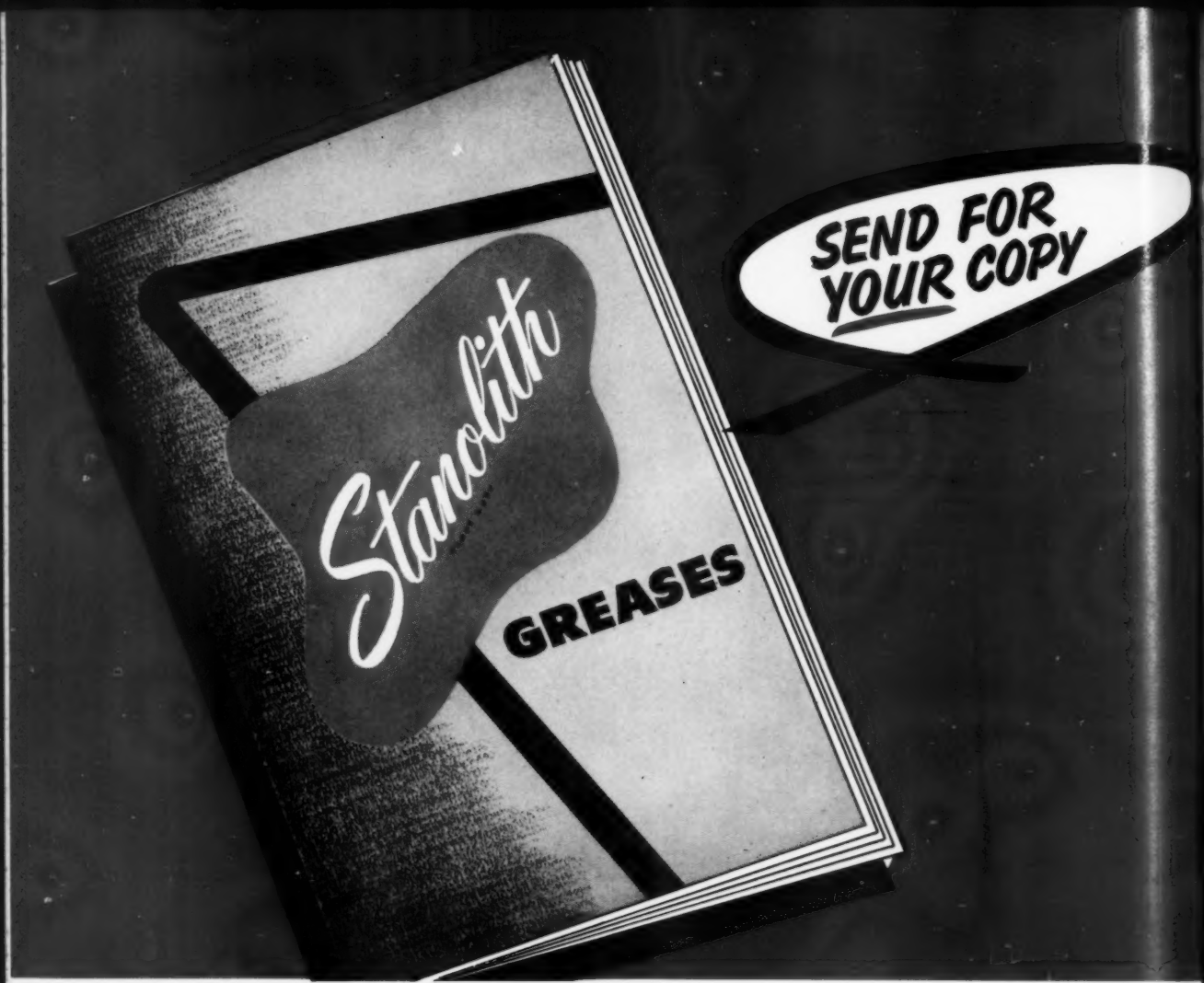

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64—See page 138. Mercury Switches: Write for further information on these switches that are not affected by dust, dirt or corrosion. Let Mercoid solve your control problems. Further information sent upon request. The Mercoid Corporation.

65—See page 134. Regulators and Thermometers: Write for Bulletins 500 and 1000 for full information on the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer. Their low initial cost will be repaid many times over during their first year of service. H. O. Trerice Co.

66—See page 135. Pressure Regulators: Accurately regulating at any pressure between the initial pressure and atmosphere in one stage, these regulators operate control valves from ½ inch to 6 inches. Bulletin No. 1B gives full facts. Atlas Valve Co.

67—See page 140. Temperature Regulators: Write for Stacon Bulletin 50-1000 outlining full details on this extra sensitive, accurate, economical temperature regulator. Permits temperature regulation to plus or minus one degree Fahrenheit! Farris Stacon Corporation.

68—See page 25. Sarco Drainage System: Sarco is saving money and increasing production for Eclipse Piece Dye Works. See interesting details in ad on page 25. Sarco experience in using hot condensate for other purposes may save thousands of dollars in your plant. Products also include self-operated and electric controls for all wet process operations. Write for the catalogs. Sarco Co., Inc.

STEAM TURBINES AND ENGINES

69—See page 33. Steam Engines: Write for complete data on the operating features of Troy-Engberg steam engines for driving power plant and processing equipment. Troy Engine & Machine Co.

70—See page 48. Power Saving Turbines: Eight-page Bulletin S-116 illustrates and describes application, construction, savings effected and advantages of the Terry solid wheel turbine. Write for your copy now. The Terry Steam Turbine Co.

71—See page 2. Turbines: Write for Bulletine 135 which explains the pilot operated excess speed safety trip which only Coppus Turbines offer you for extra protection for your turbine investments. Coppus Engineering Corp.

TOOLS AND SMALL SPECIALTIES

72—See page 129. Small Tube Cleaners: With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. No leakage. No stalling at low speeds. Send for ROTOJET Junior Bulletin. Elliott Company — Roto Division.

73—See page 122. Tube Expanders: These ideal Ace Tube Expanders insure dependable, economical service. Suitable for rolling new tubes and re-rolling tubes with flared or beaded ends. Minimum friction —absorbed by bronze bearing between guard and frame, resulting in much easier and faster operation. See your dealer or write today for general catalog on complete line of tube expanders and tube cutters. The Gustav Wiedeke Company.

74—See page 119. Tube Expanders: Designed to permit fast, uniform rolling of condenser tubes; tapered bevel-nosed rolls produce smoother unridged surfaces; ball-bearing thrust eliminates friction. Write for full information. Airetool Manufacturing Company.

75—See page 116. Stocks and Dies: Reversible ratchet stocks simplify pipe threading close to walls, in corners and restricted areas. Adjustable dies have "backed-off" teeth. Start and cut easily, hold sharpness. Write for full catalog. Armstrong Bros. Tool Co.

TRAPS, STRAINERS AND SEPARATORS

76—See page 51. Impulse Steam Trap: Discharge continuously under heavy loads,

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers or letters of the paragraphs describing the items you want in the spaces provided on cards.

To: INDUSTRY AND POWER, St. Joseph, Michigan **August, 1950**

Please have forwarded to me, at no obligation, the literature I've indicated by the following Key Numbers and Letters:

Advertised Products Numbers (begins Page 26)	*New Equipment Numbers (begins Page 8)*	*New Bulletin Letters (begins Page 20)*
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readers' guide to advertised products

(Continued from page 37)

quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

77—See page 118. Steam Traps: Catalog No. 250 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

78—See page 144. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

VALVES

79—See page 136. Multiport Valves: Use electrically operated H & T Poppet Type Multiport Valves to make your zeolite water softeners or sand filters automatic. Write for Bulletin V-1. Hungerford & Terry, Inc.

80—See page 115. All Iron Gate Valves: Made of high-test alloy iron to withstand the action of many of the strongest chemicals. Low in maintenance cost, easy to operate, long lasting in service. For full details write today. The Fairbanks Company.

81—See page 139. Valves: Bulletin "A-P" shows how Valvair's three body styles (2-way, 3-way, 4-way, and piped exhaust) plus many methods of actuating, provides over 103,000 variations to suit just about any possible set of requirements you may have. Send for your copy right away. Valvair Corporation.

82—See page 60. Check Valves: Chapman Tilting Disc Check Valves work with the stream so pipe line stresses are practically eliminated. Head losses are reduced 65% to 80%. Write for bulletin with complete information. The Chapman Valve Mfg. Co.

83—See page 133. Everlasting Valves: Write for Bulletin. In everlasting Valves, the seal actually improves with use. Quick acting, easy to operate and drop tight. Get full information today. Everlasting Valve Co.

84—See page 120. Butterfly Valves: Write for Catalog describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 84". Pressures to 125 psi. W. S. Rockwell Company.

85—See page 57. Steel Gate Valves: Body and bonnet have heavy metal sections, ample reinforcements at points under greatest stress. Straight-through ports assure minimum turbulence, erosion, and resistance to flow. See page 227, your No. 49 Crane Catalog. Crane Co.

86—See page 70. Cast Steel Gate Valves: Write today for Cast Steel Valve Bulletin —outlines all facts on money-saving Darling valves. They give better, low cost service. Wide range of sizes, types and constructions for all kinds of normal and unusual use. For pressures up to 1500 pounds. Darling Valve & Manufacturing Co.

87—See page 28. Valves: Be sure to write for full facts and for information relating to your specific steel valve application. There is no case on record where a Lunkenheimer steel valve has ruptured due to defective metal. Proves high quality of construction and material used in these steel, iron, bronze valves. The Lunkenheimer Co.

WATER TREATMENT

88—See page 6. Modern pH and Chlorine Control Book: New 96-page data-reference book describes scientific outfits and improved methods to step up boiler efficiency and prevent scale, corrosion, and embrittlement. W. A. Taylor and Co.

89—See page 135. New Versene Test Kit: Enables you to test the hardness of water in your plant in less than two minutes. As easy as telling red from blue and is accurate to within one grain of hardness per gallon. Packaged in special sturdy pocket-size plastic box. Includes enough chemical to make more than fifty separate tests. Refills available, full directions in each kit. Price is $3.00, postpaid on a money-back basis. The Bersworth Chemical Company.

90—See page 68. Water Softeners: Bulletin WC 102 explains the functions, principles and applications of Hot process Softeners and the distinctive features of Graver designs. Write for your copy today. Graver Water Conditioning Co.

91—See page 63. Water Deionizer: New MonoFlo Deionizer, single-tank method offers far simpler way to produce higher quality water, cuts regeneration time and rinse water, lower first and operating cost, less space required, production of high quality water immediately after shut downs, elimination of leakage of ions prior to exhaustion. Single-tank deionizer is made in two types to cover two broad fields—MonoFlo where standard deionized water is required; Ultra-DeIonizer where water of extremely high quality is needed. Write today for full details. Elgin Softener Corporation.

92—See page 9. Water Conditioning: Write for sound recommendations of Betz' engineers to help you select the water conditioning service best suited for your plant. W. H. & L. D. Betz.

93—See page 116. Water Treatment: Write for detailed information about solving your water treatment problems. This complete service includes each step from original survey of problem to installation of water purification equipment. General Filter Co.

WELDING EQUIPMENT

94—See page 45. Two-Stage Regulators: Data-filled folder describes two styles of oxygen regulators. R-201, for all welding and medium cutting, gives maximum delivery pressure of 75 lb. psi. R-202, for heavy-duty cutting — maximum pressure 200 lb. psi. Write today. The Linde Air Products Company.

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers or letters of the paragraphs describing the items you want in the spaces provided on cards.

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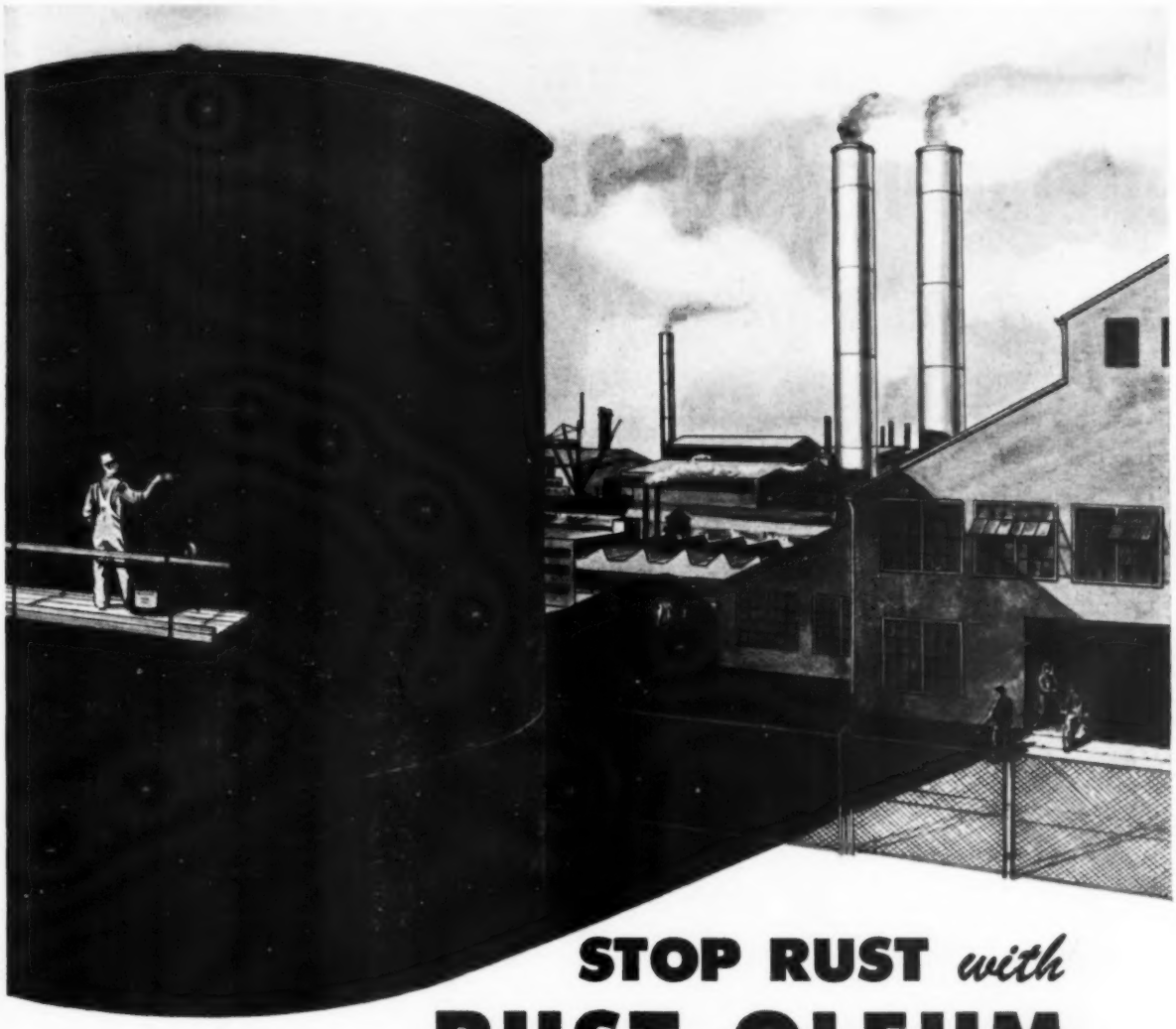

STOP RUST *with* RUST-OLEUM

If you have a rust problem, and would like a free survey and recommendations, send your name and address on your business stationery. A qualified factory representative will arrange this free service, which includes a trial size of Rust-Oleum for specific test purposes. There is no obligation on your part. Write today.

Every day rust eats away at your metal tanks, buildings, fences, stacks . . . everything metal inside and outside your plant. Yet, rust and costly rust depreciation can be *stopped instantly . . . economically* . . . with RUST-OLEUM.

Industry of all kinds . . . railroads, steamship lines, iron and steel companies, refineries, in fume-choked industrial and coastal areas have proved Rust-Oleum for more than 25 years. They know that Rust-Oleum stops and prevents rust!*

Rust-Oleum can be applied without extensive preparation . . . even over surfaces that are already rusted. Rust-Oleum spreads evenly . . . free of brush marks. Its tough, pliable finish protects against every kind of weather, against fumes and heat . . . even against salt air and salt spray.

Beauty and durability are combined in Rust-Oleum for it is available in a large selection of colors . . . including aluminum and white.

Don't wait another day! Let Rust-Oleum give you safe, sure, economical protection against rust. Use it to protect all your metal surfaces. Specify it to your painting contractor or architect. Industrial distributors in all principal cities of the United States and Canada stock Rust-Oleum to supply your every need. See Sweets for complete catalog and nearest source of supply, or write us direct.

** Names on request.*

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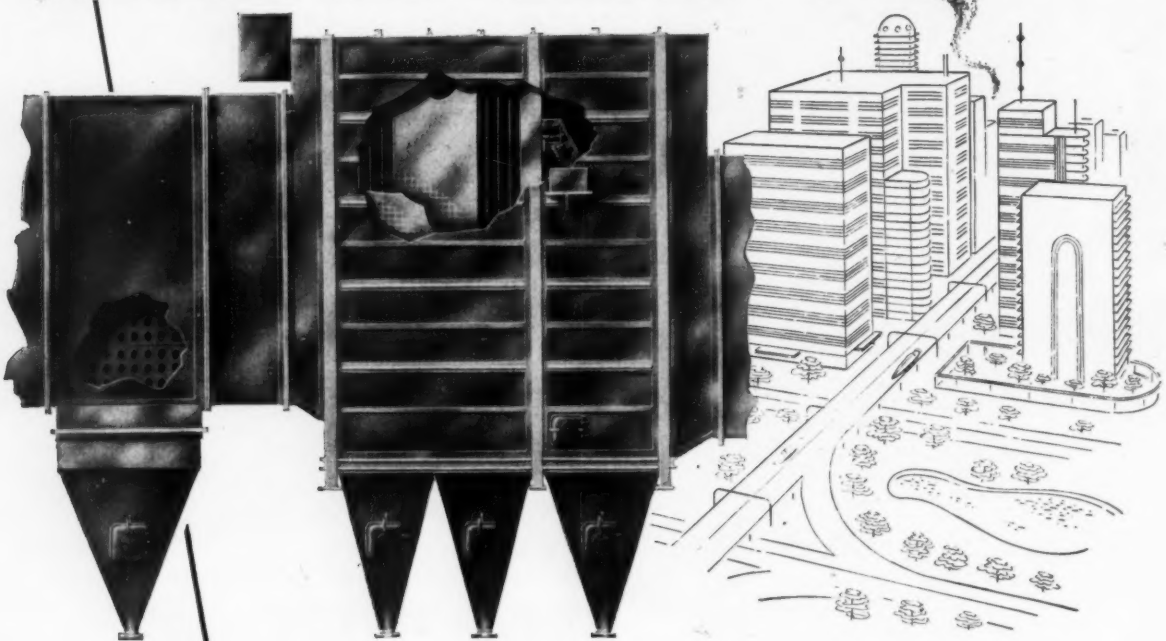
2472 Oakton Street, Evanston, Illinois

engineered for the *Future*

THE AEROTEC SERIES COLLECTOR



Your dust collection equipment, a major investment, merits a thorough survey of the present trend toward more stringent dust ordinances.

To plan for the future, a collector should meet today's collection requirements, with provisions made for increasing the efficiency when dust ordinances become more stringent. It is well known that a mechanical collector is economical to operate. Such a collector therefore, that will meet present dust ordinance requirements and serve later as the primary to an electrical secondary, seems the logical choice.

The Aerotec Series Collector provides just this service. The primary, a highly efficient Aerotec Mechanical composed of multiple small diameter tubes, will meet most stringent dust ordinances in effect today. Should collection requirements be increased, the secondary, an Aerotec "Pocket-Type" Electrical Precipitator, is easily added to provide the finest in dust collection efficiency.

The Thermix Corporation, Project and Sales Engineers for the Aerotec Corporation, welcomes the opportunity to prove the sound engineering behind this arrangement . . . a combination engineered for the future.

AEROTEC

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Connecticut

Canadian Affiliates: T. C. CHOWN, LTD., 1440 Saint Catherine St., W., Montreal 25, Quebec; 50 Abell St., Toronto 3, Ontario

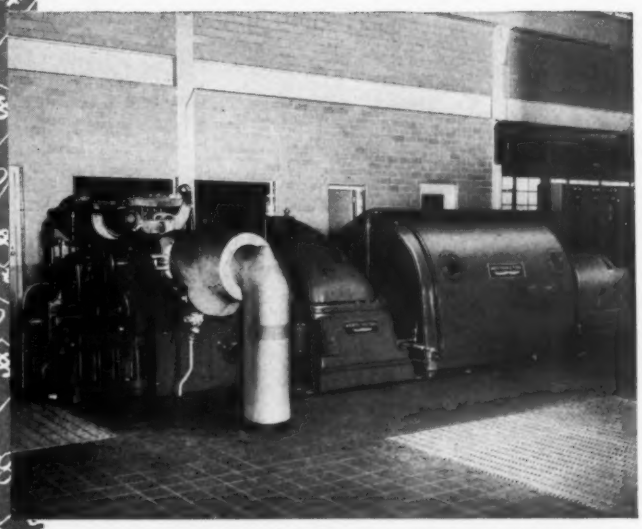
THE AEROTEC CORPORATION

GREENWICH, CONN.

FACTS ABOUT THE

Most Profitable Turbine Generator Investment

YOU CAN MAKE...



One of two Worthington 4000 kw turbine generator sets installed in a mid-western municipal power plant, operating on 600 #G and 750 F.T.T. Steam exhausting to 28" Hg vacuum.

Worthington's Experience and Undivided Responsibility Assure Low Cost, Dependable Power

Builders of steam turbines for over 30 years, Worthington's Steam Turbine Division is backed by the experience and resources of the entire Worthington organization — recognized leaders in the power plant field for more than a century. In view of today's increased turbine pressures and temperatures — and the resulting needs for new and special materials — this vast, combined source of technical knowledge has proved of tremendous practical value in developing turbine design, construction and performance.

Generators Are Worthington's, Too

The generators used with Worthington Turbines are built by a Worthington subsidiary that has specialized in this field for over 45 years. This means that Worthington, as manufacturers of *complete* turbine generator units, assumes *undivided responsibility* for the coordinated design, assembly and performance of these units.

Before shipment, Worthington Turbines and Generators are assembled together *as units* for testing and adjustment — eliminating the necessity for doing this after installation. Also, for installation and service, Worthington turbine specialists and regular Worthington service men are always available from our District Offices throughout the country.

Check These Over!

Adding up, Worthington's matchless power plant experience . . . huge manufacturing facilities . . . long specialization in both turbine and generator manufacture . . . undivided unit responsibility . . . and skilled technical service . . . are the best assurance you can get anywhere of efficient, economical steam turbine power.

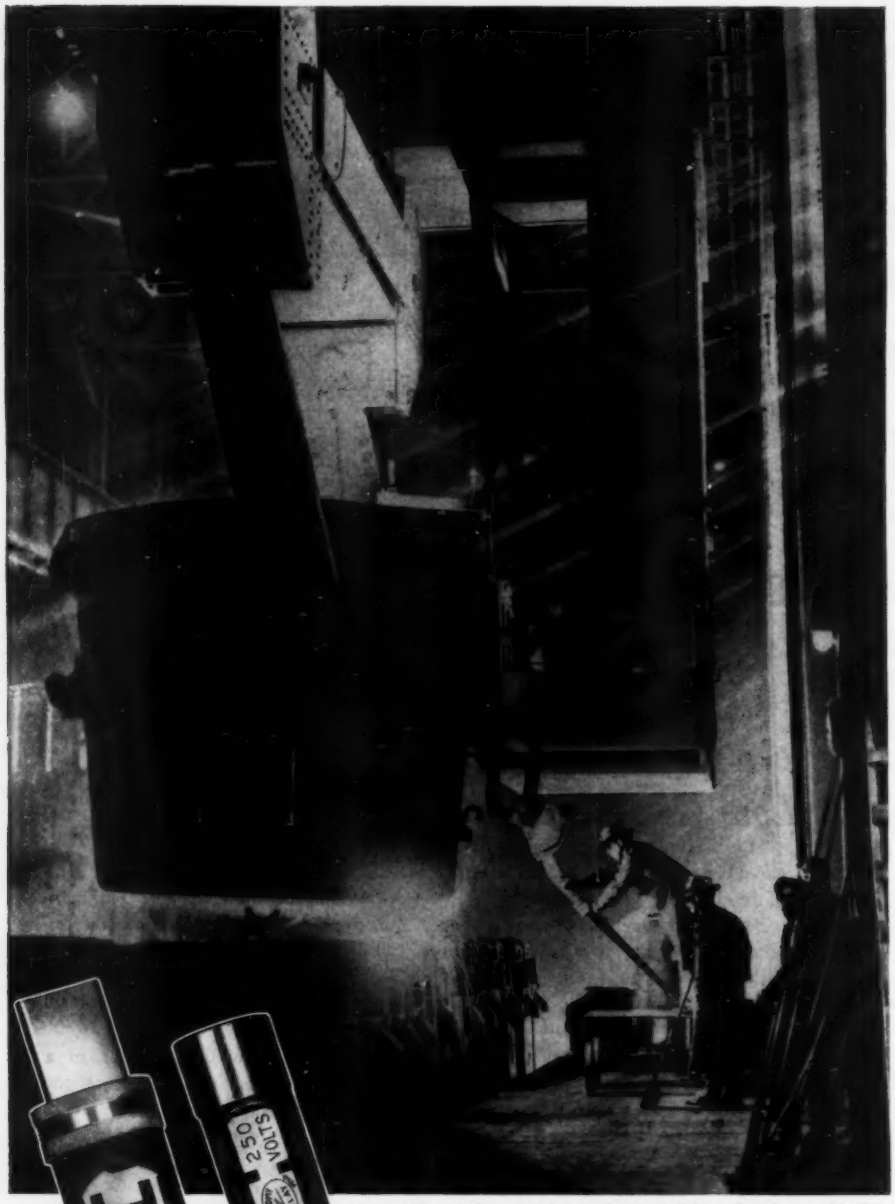
Worthington makes turbines in a wide range of sizes and types, each one designed to make steam do more work. For details proving *there's more worth in Worthington*, contact your nearest Worthington representative. Or write to *Worthington Pump and Machinery Corp., Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

T0.2

A GREAT TEAM IN STEAM



In handling molten metal or other materials undergoing rapid changes, needless delays of even a few seconds cannot be tolerated.

it **PAYS**
to have
"De-Lays!"

Economy "De-Lays" Prevent Production De Lays!

Modern ECONOMY "De-Lay" Fuses

In such operations, the advantages of Economy "De-Lay" Fuses are especially apparent. They do not "blow" under momentary overloads in the 135 to 200% range where most "blows" occur. Hence delays due to current failure are reduced to the minimum.

Economy "De-Lay" Renewable Fuses and Renewal Links are distributed by leading Electrical Wholesalers.

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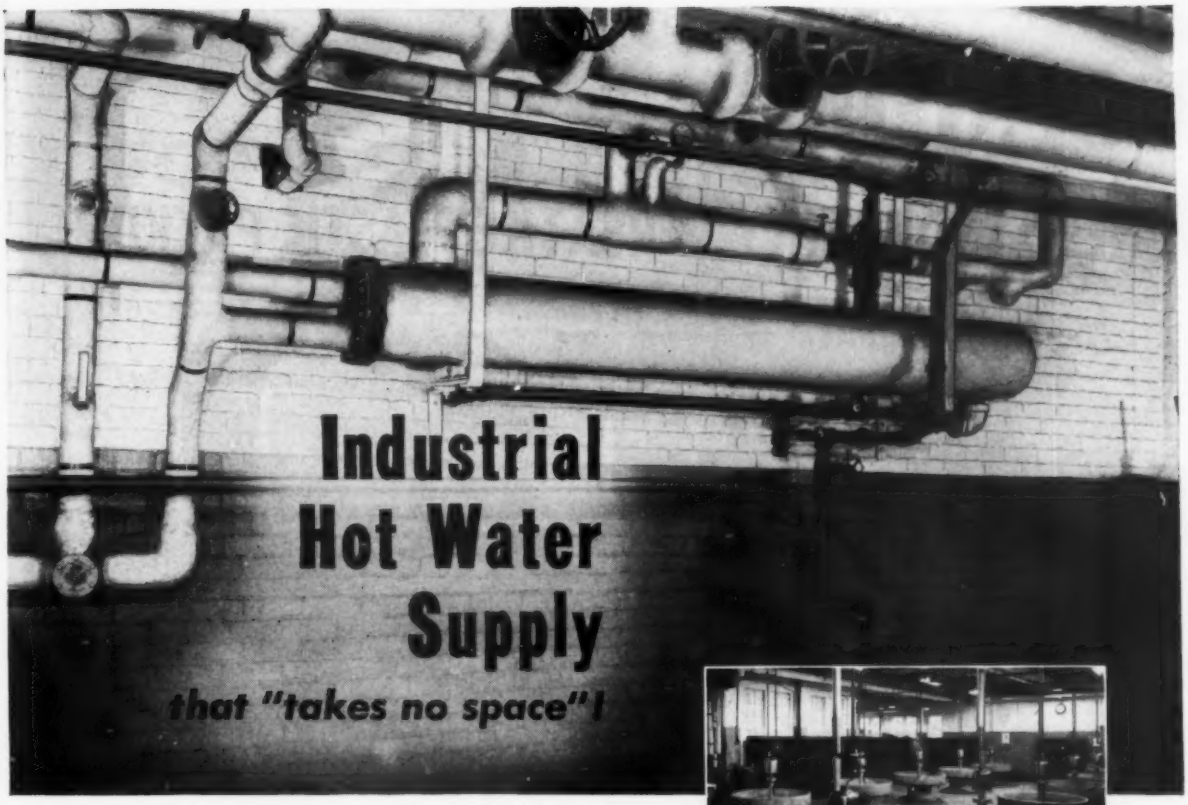


This General Instantaneous Water Heater installation at Nicholson File Company supplies 96 gpm at 125° F. for 12 Bradley wash fountains in the Cutting Dept. washroom.

Think of all the headaches avoided by this compact, simple G F hot water heater that supplies 96 gals. of 125° water a minute. No space problem, because it's mounted on the wall . . . out of the way. No major construction is involved either, because it has no tank, no complicated piping. Installation required minimum of planning, minimum amount of work. And the unit is located near the washroom . . . no long runs of piping, no heat waste.

Maybe you have a similar water heating problem that can be solved as economically and as easily. General Instantaneous Water Heaters supply up to 300 gallons of clean hot water a minute through seamless copper tubing . . . 19 sizes, the largest measuring less than 15″ by 120″. Heated with steam through shell . . . all waterways non-corroding bronze or copper.

Here's the efficient way to boost hot water capacity without building an addition to your plant or crowding your boiler room. Why not get all the details? Send for new Catalog No. 19. General Fittings Co., A-123 Georgia Avenue, Providence 5, R. I.

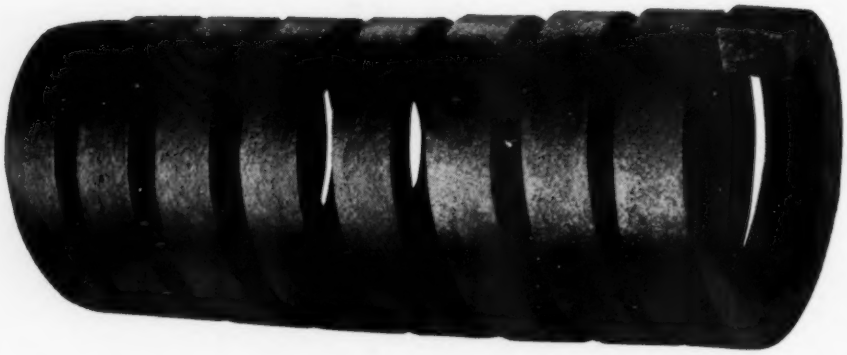
GENERAL instantaneous water heaters

Products of General Fittings Co., makers of Tankless and Indirect Water Heaters and Heating Specialties.

General Instantaneous Water Heaters 19 sizes up to 300 g.p.m.

versi-pak®

A NEW AND HIGHLY VERSATILE PLASTIC PACKING



versi-pak is the result of more than two years of testing and development. This new plastic packing can be used in an exceptionally large number of applications, and simplifies storage and inventory problems. It is being used successfully in reciprocating and centrifugal equipment and in hydraulic systems. Recommended for temperatures up to 350°F.; pressures up to 600 p.s.i.; against air, water, low-pressure steam, and a long list of chemicals. Available also in non-graphited form (R/M No. 1846) for use in food-handling equipment. For your free copy of the new bulletin on **versi-pak** send the coupon below to the Packing Division, Manheim, Pa.

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Gentlemen: ☐ Please send me a free copy of the **versi-pak** bulletin.

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RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment Brake Linings • Brake Blocks • Clutch Facings Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

FOR 5-STAR PERFORMANCE

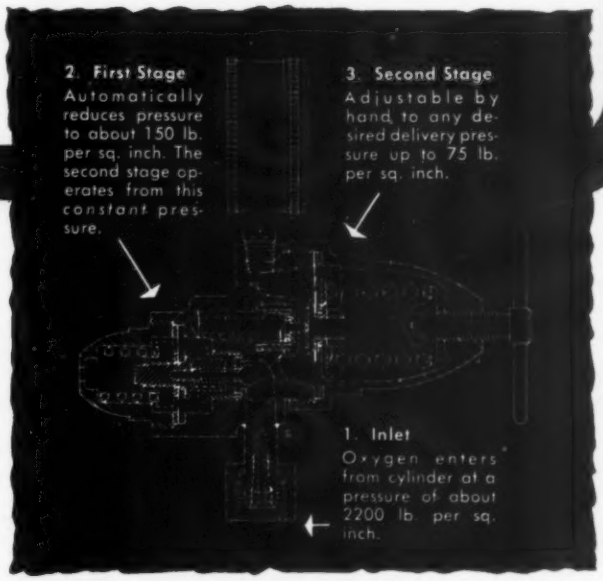
PUROX

Trade-Mark

TWO-STAGE REGULATORS

- ★ ACCURATE
- ★ SENSITIVE
- ★ EFFICIENT
- ★ STURDY
- ★ DEPENDABLE

(Right) Type R-201 Oxygen Regulator (maximum delivery pressure 75 lb. per sq. in.) for all welding and medium cutting. For heavy-duty cutting, use the R-202 (maximum delivery pressure 200 lb. per sq. in.), which is similar in appearance. The R-203 Acetylene Regulator is the companion for both.


2. First Stage
Automatically reduces pressure to about 150 lb. per sq. inch. The second stage operates from this constant pressure.
3. Second Stage
Adjustable by hand to any desired delivery pressure up to 75 lb. per sq. inch.
1. Inlet
Oxygen enters from cylinder at a pressure of about 2200 lb. per sq. inch.

Experienced operators rely on PUROX Regulators to give them the exact pressure and volume of oxygen and acetylene needed to do a first-class job. They know that accuracy and sensitivity in PUROX Regulators depend on large-diameter diaphragms and good engineering design — not on delicate mechanisms that need constant care and adjustment.

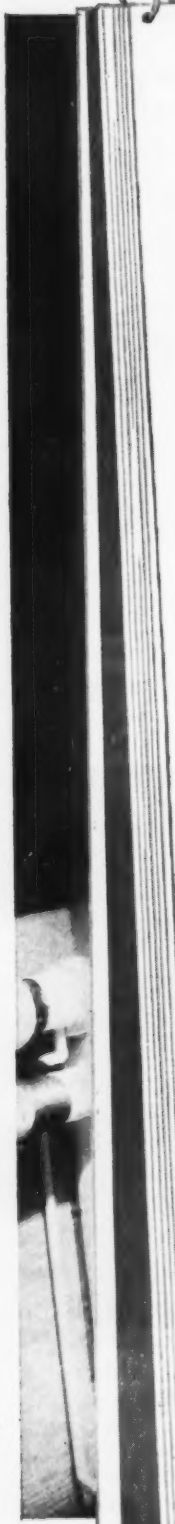
They're familiar with the easy-to-read gauge dials . . . uniform pressure control that permits one-time flame adjustment . . . pressure-forged bodies and caps that give great strength with a high margin of safety and minimum weight . . . the built-in durability that makes PUROX Regulators such dependable performers with so little maintenance.

ORDER FROM YOUR LOCAL JOBBER

For jobber's name and free folder describing PUROX apparatus, write to The Linde Air Products Company, 30 East 42nd Street, New York 17, N.Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

The term "Purox" is a trade-mark of Union Carbide and Carbon Corporation.

Sinclair Rubilene Resists Oxidation Gives Long, Low Cost Service



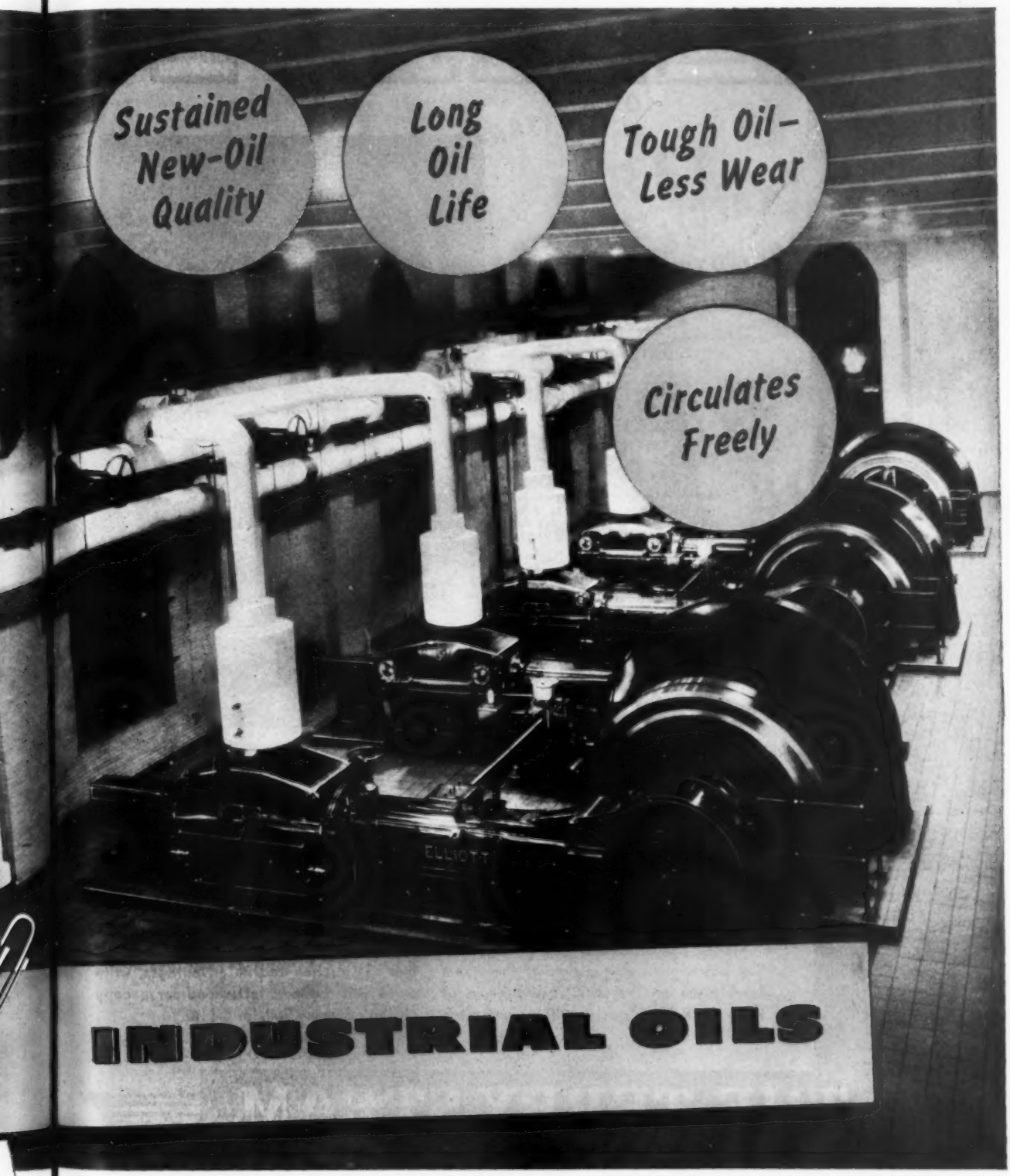
Oxidation attacks oil wherever there is continuous recirculation—in enclosed crankcase systems and, especially, in central circulating systems. It forms damaging acidic compounds, gum, carbon, and sludge. Result: frictional drag is increased, oil lines may become restricted or closed, wear accelerated, efficiency and life lowered.

Many years of experience show Sinclair Rubilene successfully withstands oxidation even under sustained high temperatures. This is due to Rubilene's greater stability and ruggedness. At the same time non-foaming Rubilene assures a solid flow of oil to provide a tough oil cushion between all moving parts. Rubilene thus lessens friction and wear and provides high efficiency and smooth operation.

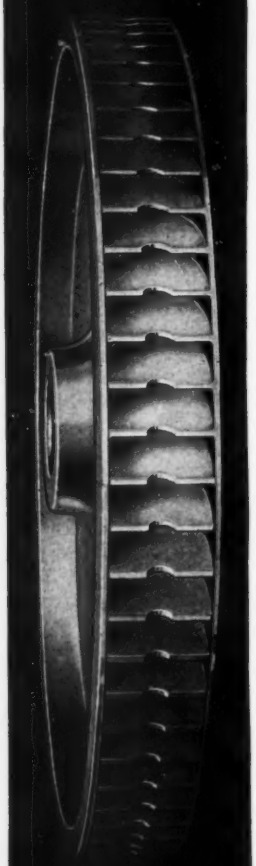
Why not eliminate worry over damaging oxidation and assure reliable lubrication? Use Sinclair Rubilene Oils.

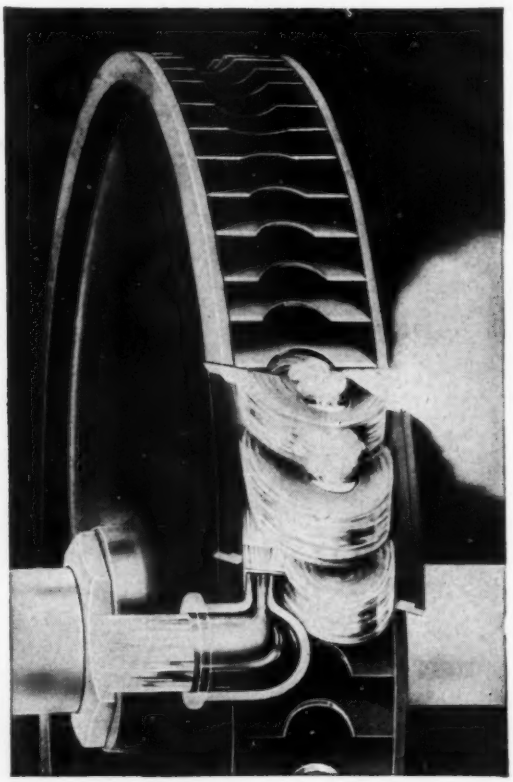
Your nearest Supplier of Sinclair Products will gladly arrange for lubrication counsel, or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

SINCLAIR


Sustained New-Oil Quality
Long Oil Life
Tough Oil– Less Wear
Circulates Freely
INDUSTRIAL OILS

TERRY





Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

NO PARTS TO LOOSEN OR WORK OUT

The rotor of the Terry Wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the solid curved backs of these buckets or pockets. Therefore close clearance is unnecessary and wear on the blades forming the pockets is of little consequence, as it does not materially affect horsepower or efficiency.

For detailed information about this effective construction and its advantages, write us on your business letterhead for a copy of Terry Turbine Bulletin S-116.

T-1172

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

*

Four 930,000 lb. per hr. boilers—two completed and two in process of construction—in the new Phillip Sporn Plant, owned and operated by Appalachian Electric Power Company and The Ohio Power Company, both affiliates of American Gas and Electric Company, and a fifth unit of similar capacity in service at Twin Branch plant of the Indiana & Michigan Electric Company, are FIRST boilers ever built to supply steam for turbine throttle conditions of 2000 psi and 1050 F. Reheat temperature is 1000 F; boiler design pressure, 2500 psi.

Straight TUBES
Bent TUBES
Superheater TUBES
Air Heater TUBES
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Furnace-wall TUBES
Generator TUBES
Reheater TUBES
Baffle TUBES
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Complete service on all your boiler tube requirements is available through your nearest B&W Tube Representative and through local distributors in principal cities.

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B&W SEAMLESS and WELDED TUBES

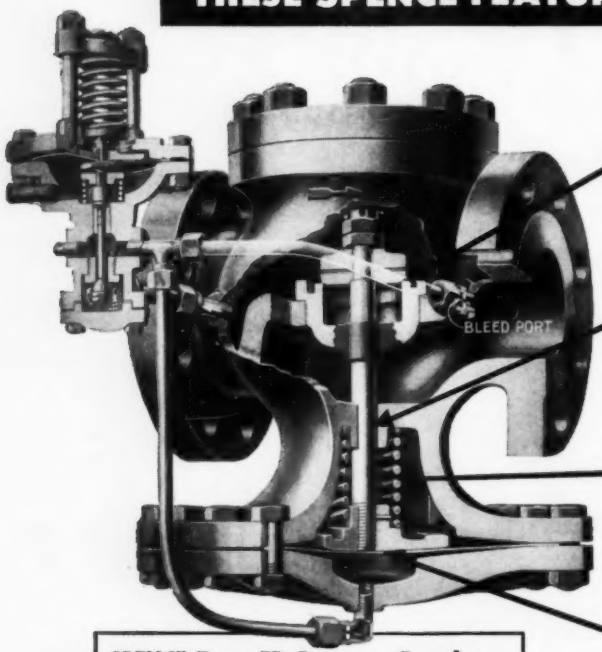
SAY B&W BEFORE YOU SAY BOILER TUBES
. . . for long-term service satisfaction and economy

TA-1543 C

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

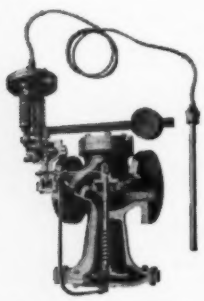
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

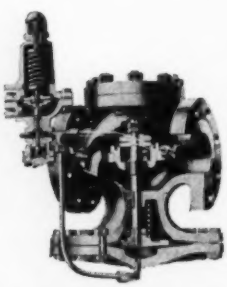
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

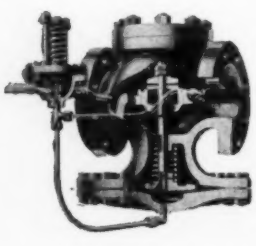
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

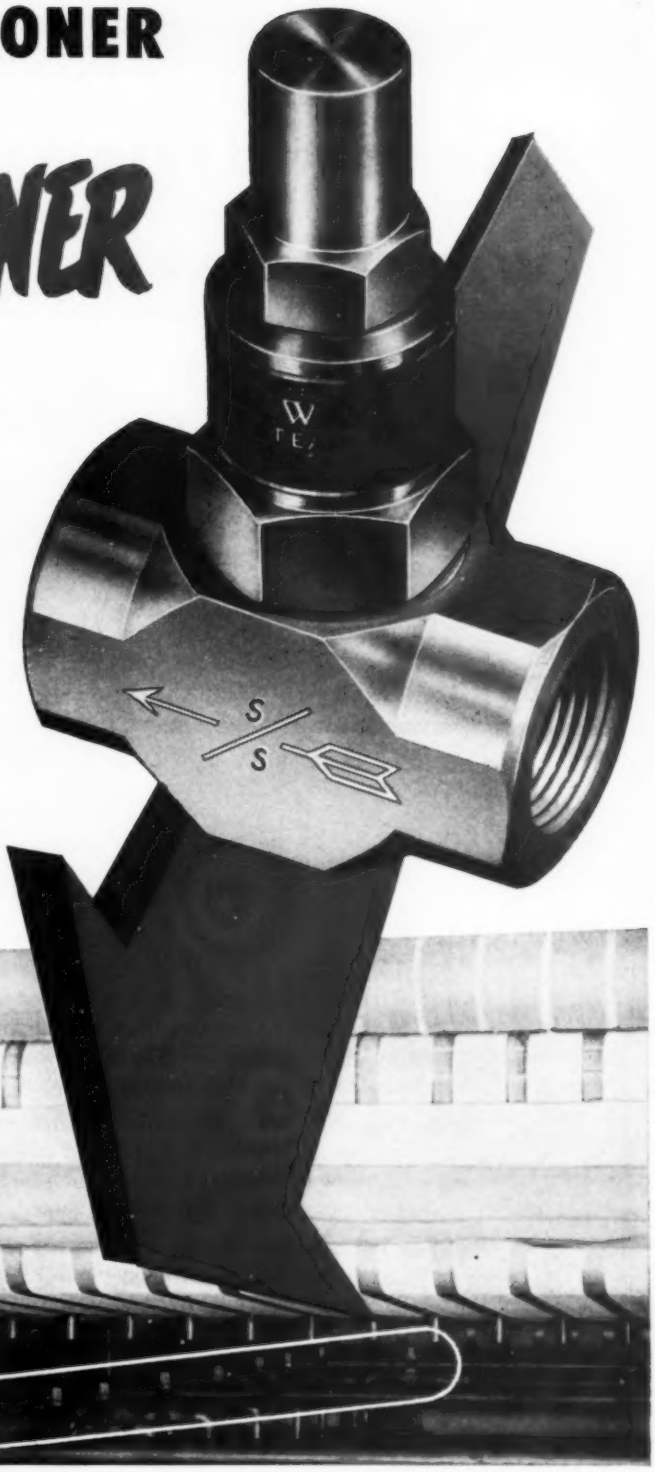
The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

WHY THIS BIG IRONER GETS HOTTER, SOONER



There are 9 reasons—the 9 Yarway Impulse Steam Traps draining the 8-roll Hoffman installation in the all-Yarway-equipped laundry at Temple University Hospital, Philadelphia. The other Yarways are on tumblers, presses, water heater, etc.

In laundries and cleaning plants—as in all plants using steam equipment—profitable operation depends on equipment getting hot *quickly,* and *keeping continuously* at peak temperature for the full operating period.

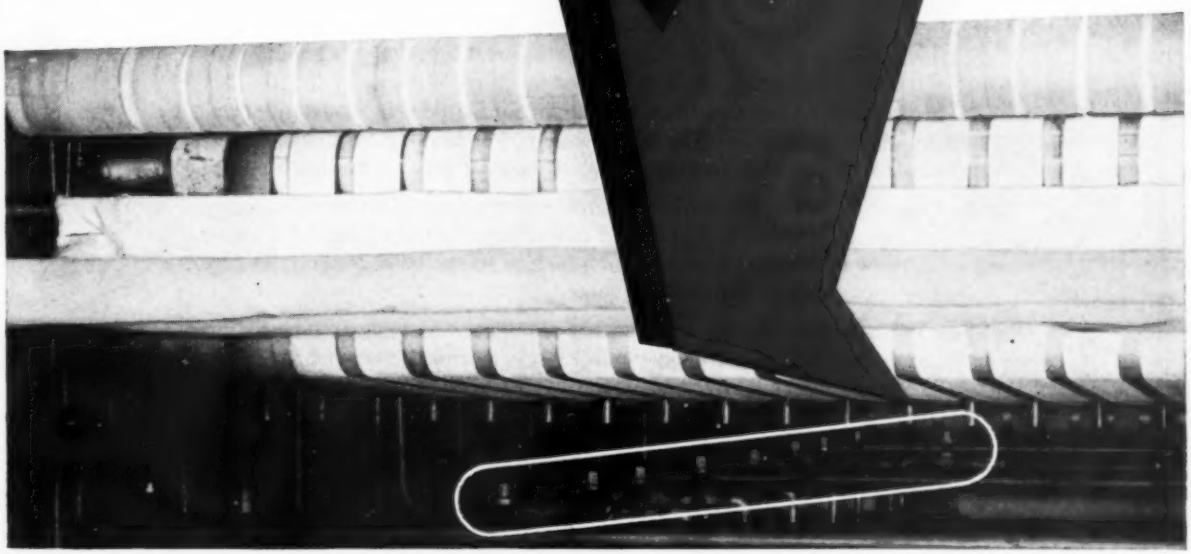
Yarways do this by opening wide during heating-up period to discharge air and condensate *fast.* Then, when peak temperature is reached, the trap discharges heat-retarding condensate as it forms instead of waiting for quantities to accumulate. Result—maximum temperature . . . maximum operating profits!

Other Yarway features—only one moving part (a little valve), low maintenance, easy installation, low cost. More than 650,000 have already been installed.

Yarways are sold by more than 200 distributors in the United States and other countries.

Install a Yarway on free trial in your plant. See your nearest distributor, or write to . . .

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.



Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

FOR HIGH EFFICIENCY WITH VARIABLE FAN OUTPUT

THE NEW Sturtevant VANE CONTROL

Sturtevant Vane Control has been universally accepted as the economical way to obtain variable fan output at high efficiency. It provides instantaneous regulation of output for fans driven by constant-speed motors. In addition, it offers substantial power savings over other types of control at the high ratings at which most of today's boilers operate.

Easily Operable—Vane Control is a simple mechanism which remains easily operable under hot and cold conditions. Notice in the illustration how a cast-iron closure which fastens to the cone of the inlet box completely shrouds the center mechanism from the gas stream.

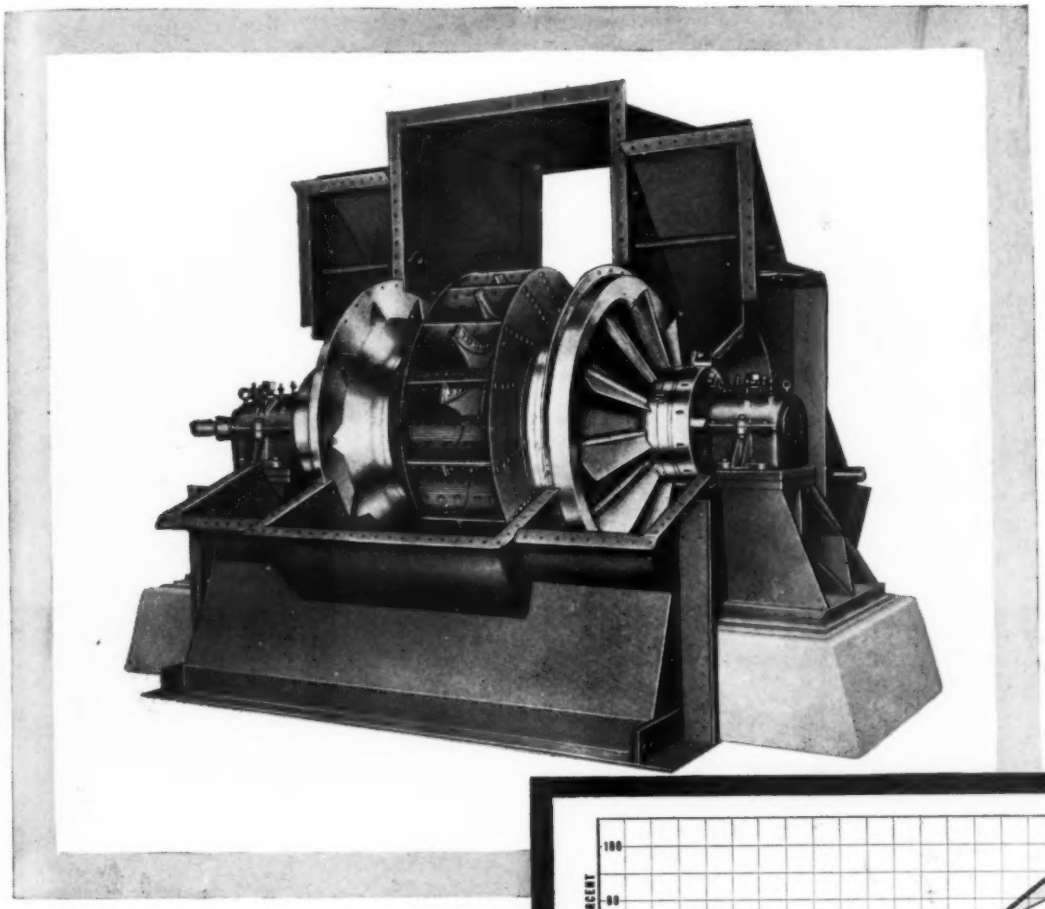
Full Fan Performance—Vanes are pivotted along conical elements to provide sufficient free area to achieve full fan performance when wide open. This conical arrangement of heavy cast or die-formed parts insures extreme rigidity to resist thrust loads.

Link and Lever Action—The mechanism operates to give synchronized motion to vanes by link and lever action without the use of gears. Linkage from the operating shaft to the vane center is designed to effect a more rapid motion of vanes in the open range, and a slower motion in the near-closed position where finer adjustment is desired.

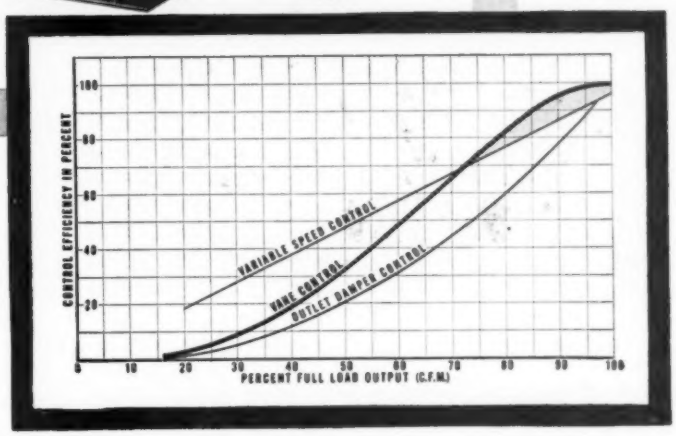
No Lubrication—No lubrication is necessary on any of the interior mechanisms of the control. Arrangement permits easy accessibility of all parts for inspection and maintenance.

For full information on Vane Control, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

Cutaway of a Sturtevant Induced Draft Fan, showing Vane Control shielded from the gas stream but open to access from the outside, and the Sturtevant E-R (Erosion Resisting) Wheel.



The comparison of control devices can best be shown by the relative "efficiencies" of the controls. Notice the "plus" region of Vane Control shown by the shaded area.

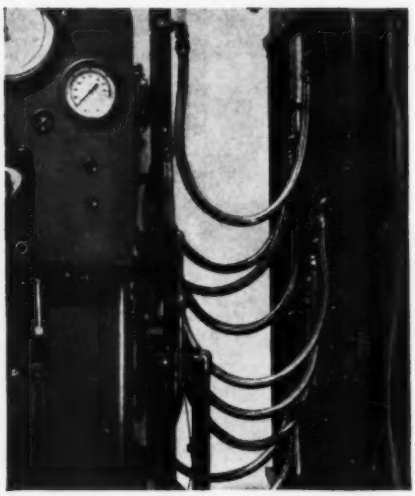


YOU CAN BE SURE...IF IT'S

Westinghouse

J-80192-A

make it **flexible** and pressureproof



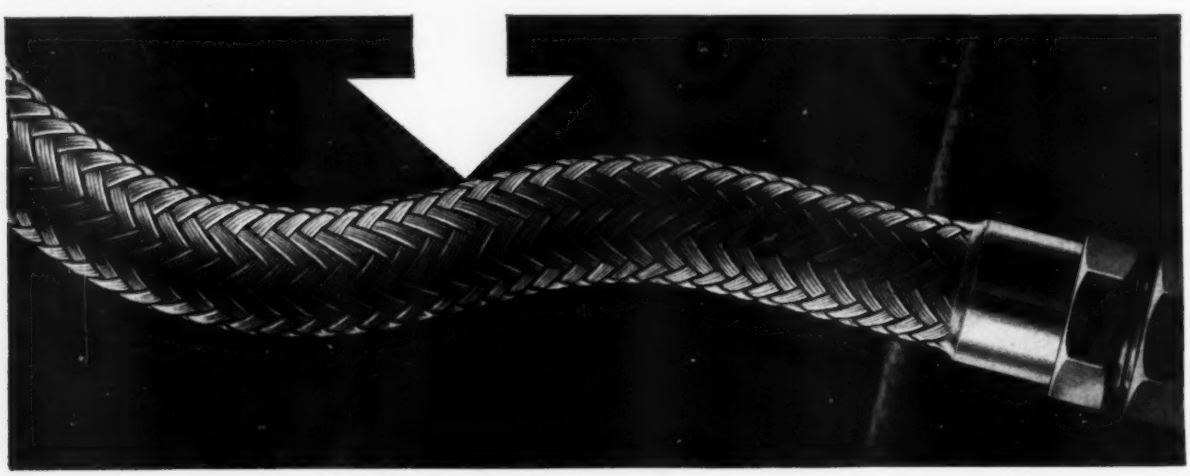
Steam to the moving platens of this hot plate press, made by Williams, White & Co., of Moline, Ill., is carried through these ½" I. D. Bronze American Seamless Flexible Metal Connectors.

Are you plagued with piping that must move, that vibrates, or has connections that are out of alignment?

Whether it carries fluids, gases, semisolids or steam, there's a type of American *Seamless* Flexible Metal Tubing or Flexible Metal Hose to do the job. Neither heat, pressure nor corrosion presents a problem.

American Seamless Flexible Tubing is made of seamless corrugated tubes of bronze and other workable metals, in standard sizes from ⅛" up. They are reinforced with one, two or three pressure-resistant coverings of wire braid. American Flexible Metal Hose is made of spirally wound continuous strips of brass, bronze, aluminum, steel and other metals in ⅛" to 12" I. D. sizes.

For illustrated literature, or the help of our Technical Department, just address The American Brass Company, American Metal Hose Branch, Waterbury 88, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.

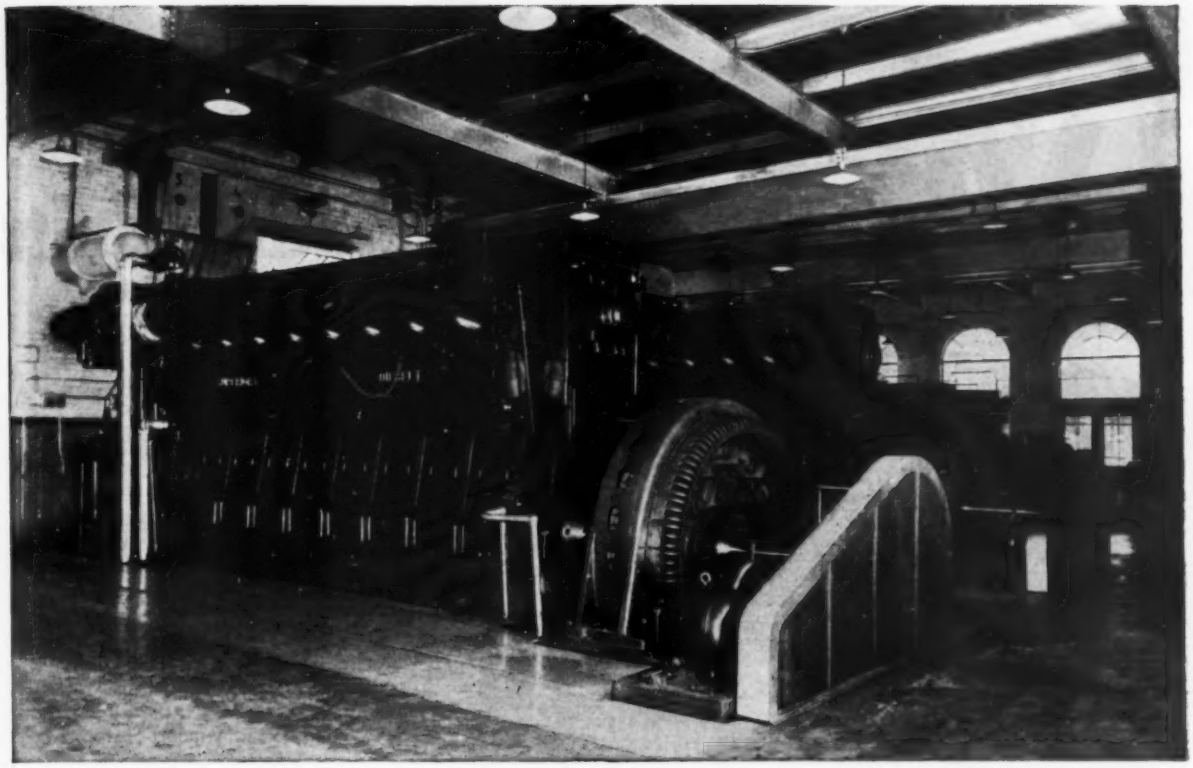


wherever connectors must **move**

ANACONDA

American

FLEXIBLE METAL HOSE AND TUBING



THEY BURNED THE MORTGAGE IN LESS THAN 10 YEARS

● An Arkansas town started a power generating plant over 10 years ago with three Superior Diesels. When they threw the switch on this new venture they had a $49,000 debt. In less than 10 years they burned the mortgage.

Since this municipal power plant started operations, it has paid over $122,000 in power dividends to the city . . . in free street lights, and 80% discounts to schools, churches, and charities. They added another Superior Engine in 1945 . . . still another in 1946 . . . and bought their sixth Superior Diesel in 1949.

In addition to these dividends and necessary capital improvements, operating profits made it possible to repeal a special tax assessment. Today this Arkansas power plant is debt-free and making a substantial annual profit. Its customers get the lowest priced electrical power in the locality.

Careful supervision plus low cost Diesel power have added another remarkable success story to Superior's files. Chances are a Superior representative can help you accomplish the same results. Why not write and tell us when he should call, or if you prefer, send for our fully illustrated 20-page booklet.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL NSCO SUPPLY COMPANY

Superior **DIESELS**

Locomotive • Marine • Oil Field • Stationary

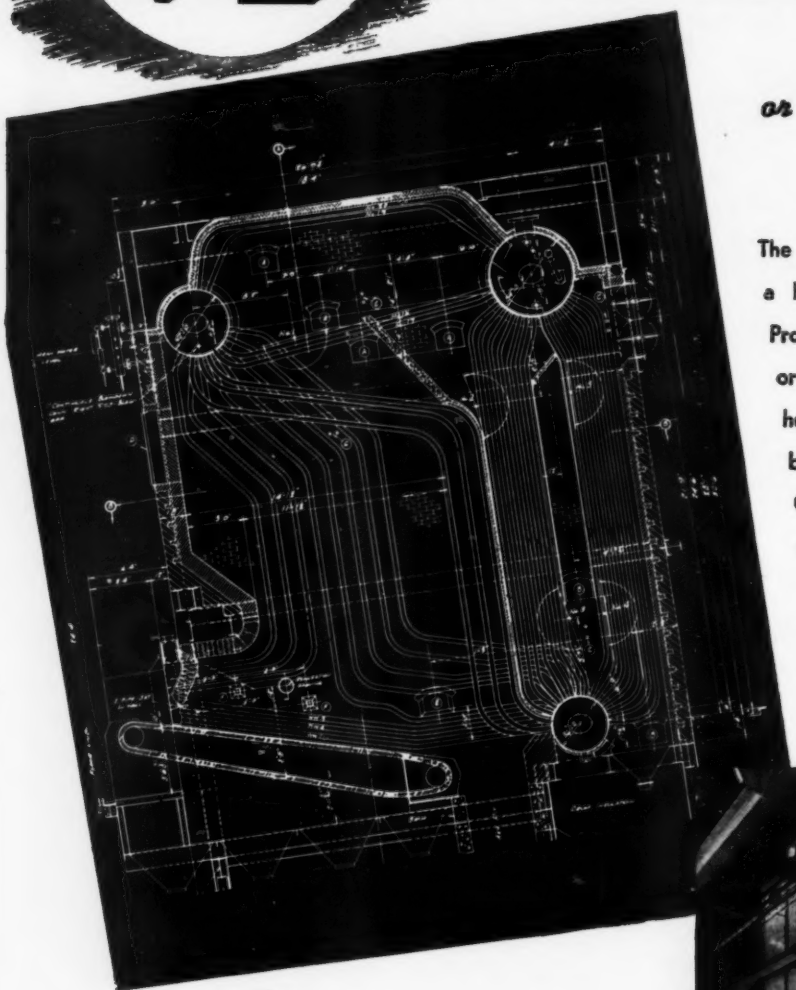
CLASS **VL**

Vogt

Steam Generating Units

for POWER *or* PROCESSING LOADS, *and* HEATING

The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.

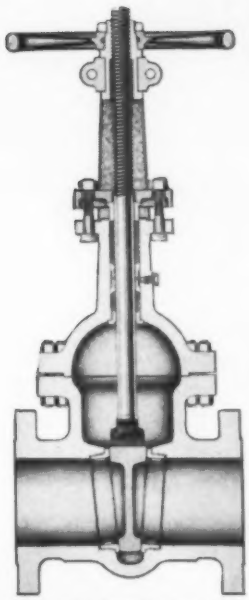


Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

For completeness of selection You can't beat the CRANE line



No. 33XR, 300-Pound Steel Gate for steam up to 850° F.; for water, oil, air or gas up to 500° F. Exelloy to Nickel Alloy seating. Sizes: 1½ to 24 in.

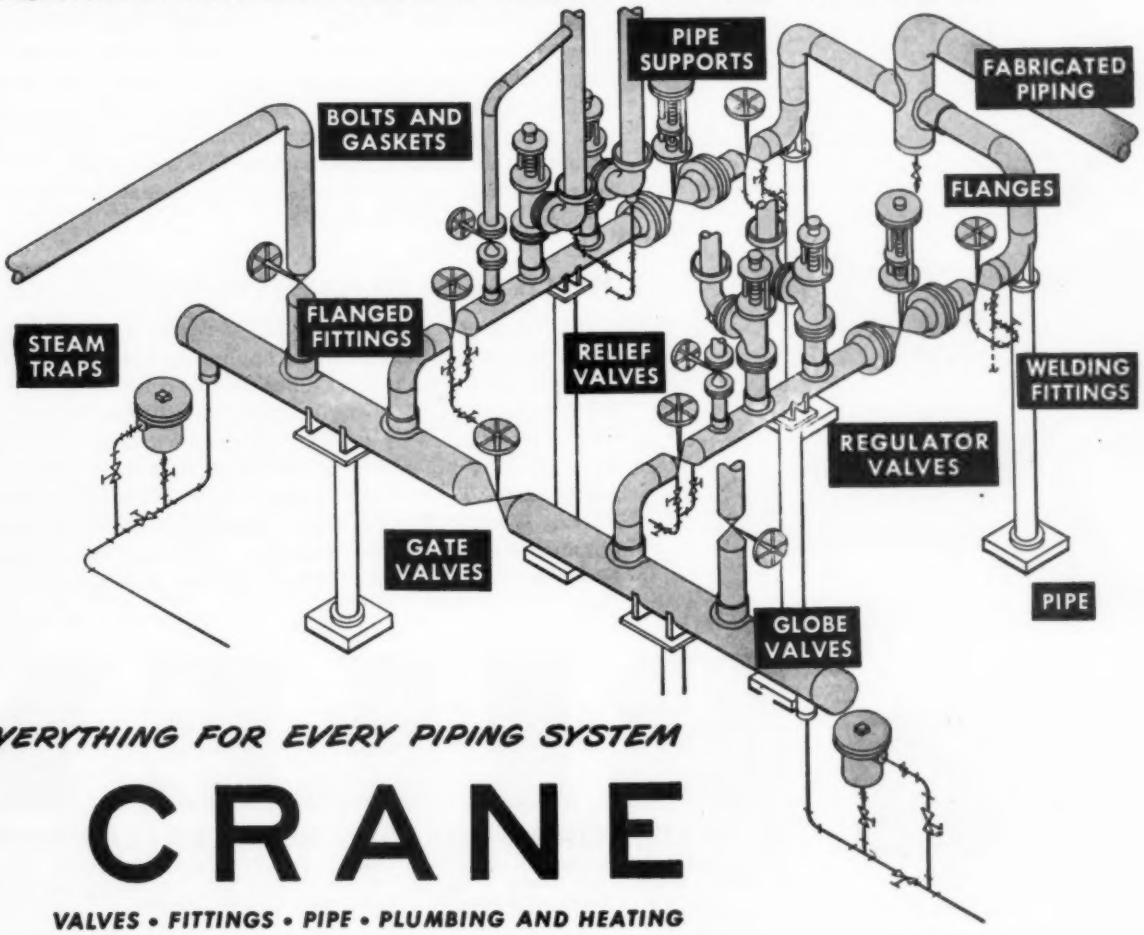
STEEL VALVES FOR SEVERE STEAM SERVICES

Crane Cast Steel Wedge Gate Valves find wide application wherever exceptionally rugged and durable steel valves are required. Body and bonnet have heavy metal sections and ample reinforcements at points under greatest stress. Straight-through ports assure minimum turbulence, erosion, and resistance to flow.

Solid wedge disc with close fitting disc guides maintains accurate seating on shoulder-type screwed-in body seat rings. "T-head" disc-stem connection prevents side strain on stem. Available in pressure classes from 150 to 1500 pounds with a variety of trim materials especially suited for recommended services. Screwed, flanged, or welding ends. See your new No. 49 Crane Catalog, p. 227.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving ALL Industrial Areas

ONE ORDER TO CRANE COVERS ALL PIPING EQUIPMENT FOR THIS PRESSURE REDUCER STATION, FOR EXAMPLE

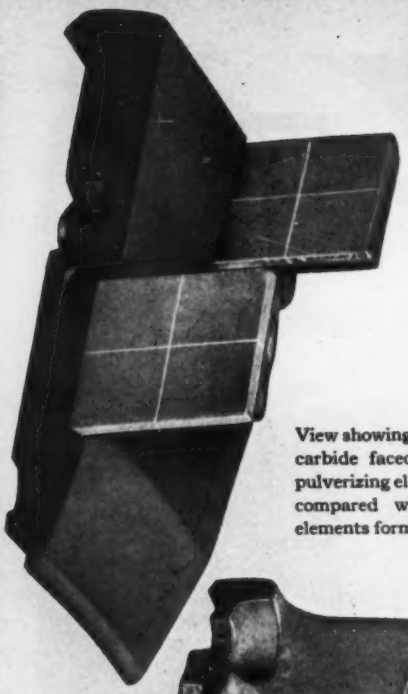


EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

Now RILEY Pulverizer Pa



View showing tungsten carbide faced moving pulverizing elements as compared with alloy elements formerly used

Stationary tungsten carbide faced pulverizing elements as compared with former alloy elements

A great pulverizer development
Hardness near that of diamond

The use of tungsten carbide facings on Riley pulverizer parts adds tremendously to the life of the parts. Such parts when pulverizing sand to accelerate wear have outlasted six sets of alloy parts without showing any measurable signs of wear. Hardness of tungsten carbide approaches that of the diamond. Experiments and developments with the use of tungsten carbide pulverizer parts were started by Riley over ten years ago.

GREATLY REDUCED MAINTENANCE

While Riley pulverizers in actual use have been in operation with tungsten carbide parts for over two years, there is still no appreciable evidence of wear. These parts are good for many more years of service. Such long life results in greatly reduced maintenance costs placing the Riley pulverizer in a field by itself.

SUSTAINED FINENESS OF PULVERIZATION

Riley pulverizers equipped with tungsten carbide parts have shown no decrease in fineness of pulverization even after many times the amount of coal has been pulverized that formerly required replacement of parts. The fineness chart shows typical experience. As no wear is discernable to the carbide facings installed in these pulverizers, fineness will be maintained for many more thousands of tons of coal. No adjustments whatsoever are required to maintain fineness.

APPLICABLE TO EXISTING PULVERIZER

In keeping with Riley's policy of developing improvements which wherever possible can be applied to existing pulverizers, tungsten carbide parts can be installed in connection with most existing pulverizers. Many Riley pulverizer users have modernized their machines by applying this improvement. The following companies are a few of the many who have applied this improvement: Lynn Gas & Electric, Central Ohio Light & Power, Edison Electric Illuminating, Iowa-Illinois Gas & Electric, Potomac Electric Power, American Viscose, New York, New Haven & Hartford R.R., General Electric, Crocker-Burbank & Co.

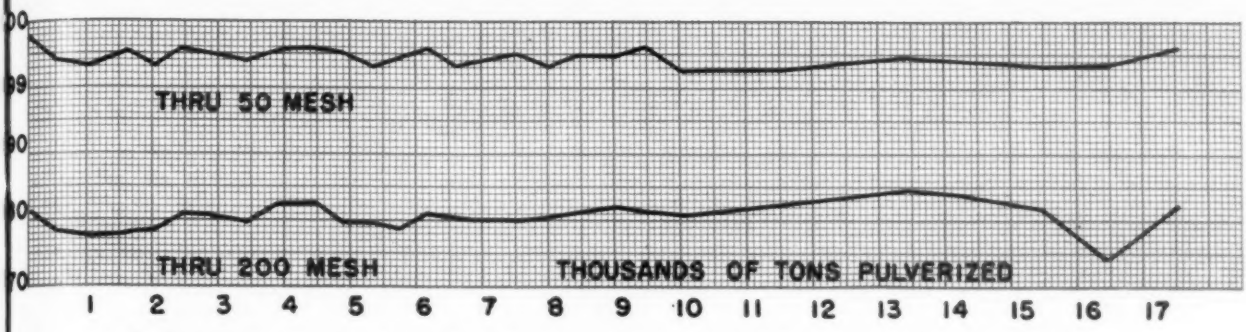
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCUBBERS

Parts with Tungsten Carbide Facings



Fineness against tons of coal pulverized. Fineness variations of any magnitude due to varying grindability.

Other operating advantages . . .

in addition to long life, low maintenance and sustained fineness of pulverization.

Flexibility—Wide Load Range

As change in coal feed gives instantaneous corresponding change in pulverized coal output—there is no lag—rapidly and widely fluctuating loads are efficiently and easily carried.

Ability to Carry Low Loads

With the combination of Riley pulverizers and burners, extremely low loads with stable ignition can be maintained. It is not unusual for load ranges of 10 to 1 or for loads under 5000 pounds of steam per hour to be carried at Riley installations.

High Primary Air Temperatures

There is no necessity of limiting primary air temperatures as a precaution against fire or explosion or because of lubricating problems. Expensive control equipment limiting primary air temperatures is not required.

Ability to Handle Wet Coals

With Riley pulverizers coal is pulverized in complete suspension, and not between two surfaces, affording the most effective drying effect from the hot air passing through the pulverizer.

Ease of Lighting

Because of small percentage of primary air, a rich and readily lighted mixture of air and coal is obtained which together with the uniform distribution with Riley burners makes lighting easy and gives stable flame at low loads.

Quiet, Vibrationless Operation

There is no comparison between Riley pulverizers and other makes insofar as quiet vibrationless operation is concerned. You hear nothing more than a motor hum.

Small Space Required—Minimum Foundations

Riley pulverizers require less space per unit of capacity. Massive deep foundations are not required due to their vibrationless quiet operation.

Explosion Proof

There has never been an explosion in a Riley pulverizer. The velocity of coal travel through the pulverizer is faster than the rate of flame propagation, eliminating the possibility of an explosion.

These Companies have installed Riley Pulverizer equipment

NORTHERN VIRGINIA POWER CO.
Riverton Station

IOWA-ILLINOIS GAS & ELECTRIC CO.
Davenport, Iowa

CARNEGIE ILLINOIS STEEL CORP.
Carrie Furnaces, Rankin, Pa.

OTTER TAIL POWER CO.
Crookston, Minn.
Hoot Lake, Minn.

PENNSYLVANIA ELECTRIC CO.
Williamsburg, Pa.

CAROLINA POWER & LIGHT CO.
Moncure, N. C.

UTAH POWER & LIGHT CO.
Provo, Utah

EDISON ELECTRIC ILLUMINATING CO.
Boston, Mass.

MONSANTO CHEMICAL CO.
Everett, Mass.

WEST PENN POWER CO.
Milesburg, Pa.

SOUTHERN IND. GAS & ELECTRIC CO.
Evansville, Ind.

KENNECOTT COPPER CO.
Chase Brass & Copper Div.
Waterville, Conn.

RIEGEL TEXTILE CORP.
Ware Shoals, S. C.

BIRD & SONS
E. Walpole, Mass.

ARMSTRONG CORK CO.
Beaver Falls, Pa.

CALUMET & HECLA CONSOL. COPPER CO.
Calumet, Mich.

HOOKER ELECTRO CHEMICAL CO.
Niagara Falls, N. Y.

CONTAINER CORP. OF AMERICA
Manayunk, Philadelphia, Pa.

CELANESE CORP. OF AMERICA
Narrows, Va.

COLUMBIA RECORDS, INC.
Bridgeport, Conn.

CROCKER-BURBANK & CO.
Fitchburg, Mass.

SAVANNAH SUGAR REFINERIES
Savannah, Ga.

C. H. MASLAND & SONS
Carlisle, Pa.

HORLICK'S CORPORATION
Milwaukee, Wis.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprising

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD • AIR HEATERS

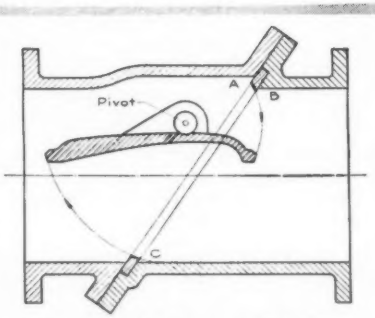
For Quick, Quiet Closing...

USE CHAPMAN *Tilting Disc* CHECK VALVES

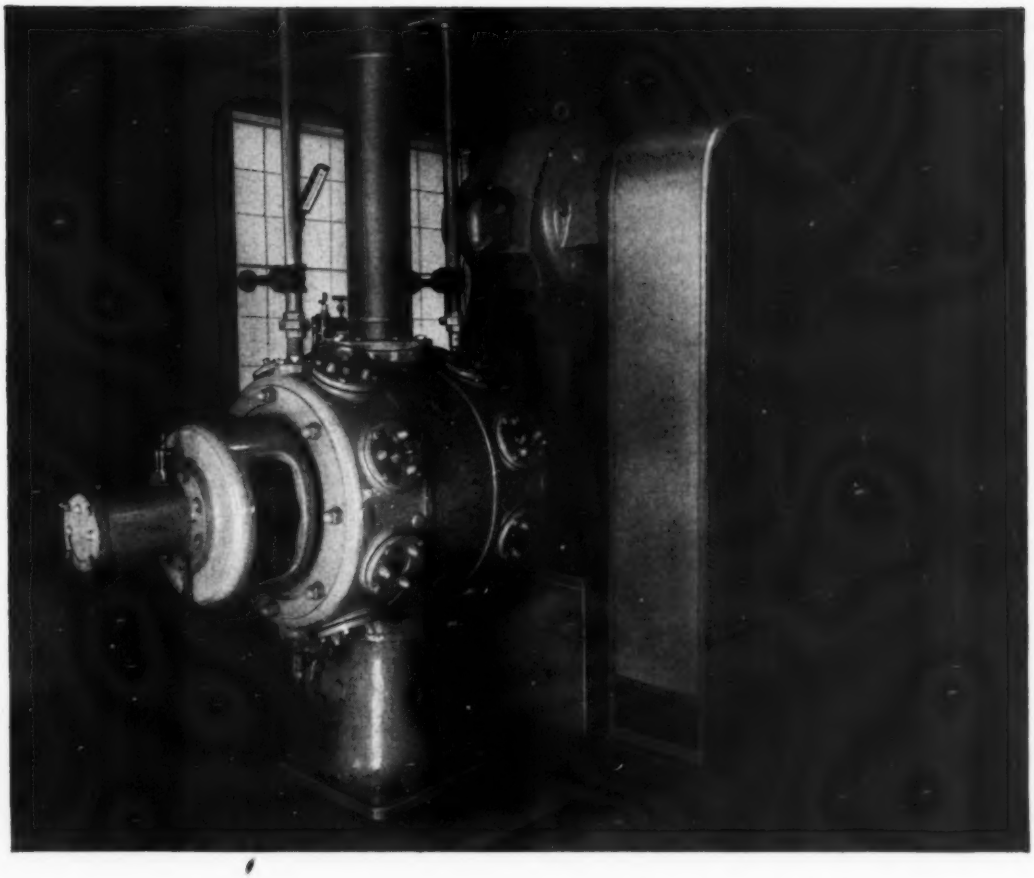
You get truly cushioned closing with these tilting-disc check valves. There's no slamming. Instead, the disc rides smoothly on the flow, opens easily, closes quickly and quietly. Because of this effortless action, power costs are lower (when used on pump discharge lines) . . . maintenance costs are lower . . . operating expenses are saved in a dozen ways.

Available in either iron or steel. Write for bulletin with complete information.

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASS.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.



oil free air

with this CP Oil-less Compressor

Where it is essential that compressed air be absolutely free from oil, to avoid injury to products, CP Oil-less Cylinder Compressors meet the most exacting requirements.

Piston and rod, completely supported by tail rod and outboard crosshead, are full floating, removing all weight from cylinder wall and stuffing boxes. This assures long life of segmented carbon piston rings, with no need for periodically rotating them.

These compressors are available in a wide range of sizes and ratings; in single and two-stage types; arranged for belt, motor or steam drive.

Write for Bulletin 728-8

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Another Modernization Case History:

has been written . . . this time at

Susquehanna Mills, Inc., Sunbury, Pa.

. . . where the management, in cooperation with its consulting engineers, the Franklin Engineering Corporation, designed, built and put in operation an entirely new and very modern steam plant. This has resulted in substantial savings in labor and fuel costs, improved working conditions, and dependable steam generation to meet rapid load changes.

Two Warren two-stage pumps were selected for Boiler Feed Service. These pumps are single suction; opposed impellers of enclosed design; bronze fitted, and having a 2″ discharge; capacity 160 g.p.m., and 710′ t.d.h. One is driven by a 60 h.p., 3500 r.p.m., 220 volt, 60 cycle motor and the other by a 60 h.p., 3500 r.p.m. steam turbine.

Modernization or Expansion . . . Power Plant or Process . . . it will pay you, too, to check with Warren.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN MASSACHUSETTS

Introducing THE ELGIN MonoFlo DEIONIZER

The long-sought, single-tank deionizer is now a reality!

One of the truly dramatic developments in the field of water conditioning is deionization, that remarkable process for removing unwanted minerals from water. For nearly all purposes, deionizing actually produces water freer from impurities than *distilled* water — and *at a fraction of its cost!*

But remarkable though this economy has been, the cost of deionization has now been further reduced by another big development. It is the Elgin MonoFlo DeIonizer illustrated below. As simple in form as a zeolite softener, it replaces the two and four-column deionizers formerly used. Naturally, it is far more economical to buy and operate; yet in many respects it is a big improvement over even the most elaborate systems.

What does it accomplish?

Compared with multi-tank methods, the Elgin single-tank method offers: (1) a simpler way to produce a far higher quality water, (2) a reduction of regeneration-time and rinse-water, (3) a lower first cost and operating cost, (4) far less space required, (5) production of high quality water immediately after shut downs, (6) elimination of leakage of ions prior to exhaustion and prevention of leakage of amines, color bodies and the like, which occurs in other methods.

The Elgin single-tank deionizer is made in two types to cover two broad fields — the MonoFlo DeIonizer for applications where standard deionized water is required; the Ultra-DeIonizer for use where water of extremely high quality is needed. Both types have the Elgin "Double Check" design particularly important in units of this type as explained below. MonoFlo units remove ionized mineral matter, but only a small portion of the CO_2 and silica; whereas the Ultra-DeIonizer units completely remove these impurities. The MonoFlo units are lower in cost and therefore desirable where CO_2 and silica are not of primary concern.

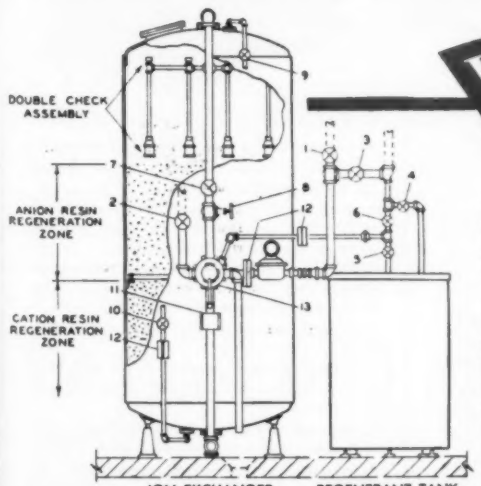
What is the quality of the water produced?

The best way to test the degree to which mineral impurities have been removed from water is to test its electrical resistance. For example, good quality distilled water has about 50 thousand ohms specific resistance . . . but . . .

Incredible though it may seem, the specific resistance of Ultra-DeIonized water is above 5 million ohms — a hundred times greater than that of most distilled water. In fact, with careful control, water having resistance over 23 million ohms has been produced. Think what that means!

Where can this unit be used?

In the past, deionizing has been used for boiler feed in high pressure plants or for processes requiring extremely pure water. However, in this simplified and more economical form, the scope of the deionizer is broadened to include lower pressure plants and many other processes where high quality water is desirable. Our engineering department will be glad to show you how it fits into your conditions. Write today.



1 HARD WATER INLET VALVE
2 DEIONIZED WATER OUTLET VALVE
3 SOFT WATER INLET VALVE
4 REGENERANT MAKEUP VALVE
5 REGENERANT SUCTION VALVE
6 REGENERANT RINSE VALVE
7 UPPER MANIFOLD VALVE
8 MID-MANIFOLD VALVE
9 AIR VENT VALVE
10 AIR INLET VALVE
11 EFFLUENT QUALITY CONTROLLER
12 RATE OF FLOW INDICATORS
13 MULTIPORT VALVE

ELGIN ECONOMICAL WATER CONDITIONING SINCE 1908

ELGIN SOFTENER CORPORATION
138 North Grove Avenue, Elgin, Illinois

HOW IT WORKS —

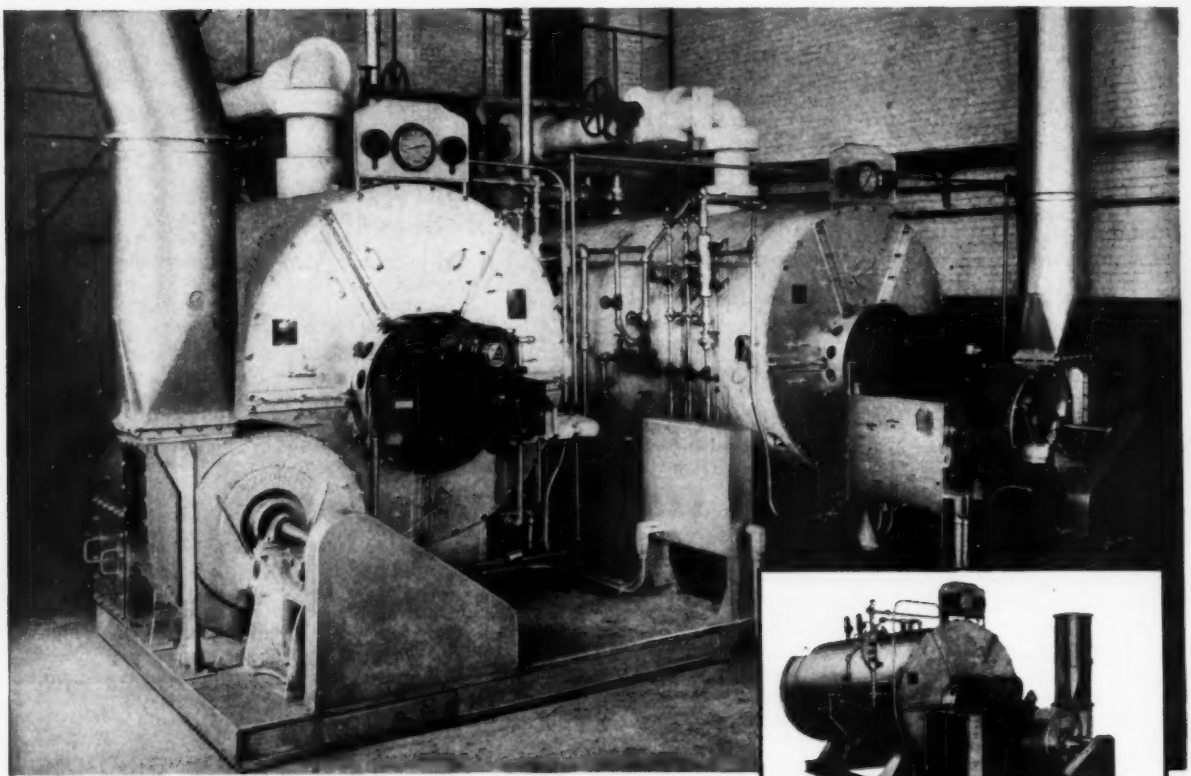
Deionization of water calls for the use of two resinous exchangers; one for the positively charged ions (the cations) and one for the negatively charged ions (the anions). One exchanger is regenerated by an acid solution; the other by a caustic solution, so this has formerly required two exchanger tanks along with other complications.

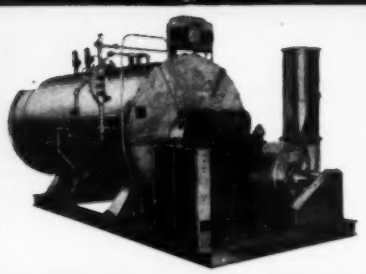
In the Elgin MonoFlo DeIonizer, the two exchangers are intermixed in a single tank during the service period. But the two exchangers used have a marked difference in density which permits them to be divided by simple backwash into two zones for separate regeneration as diagrammed. Each regenerant solution is introduced into its proper zone. Thus, in this simple unit, the engineer's dream has become a reality — water is deionized, the resin mixture separated into its components, the two resins regenerated, remixed, and again returned to the deionizing cycle. Simple manipulation of the Elgin Multiport Valve and supplementary controls accomplish (1) Backwashing, (2) Regeneration of anion and cation resins, (3) Mixing the resins, (4) Return to deionizing.

Incorporates ELGIN *"Double-Check" principle*

Note that the Elgin "Double Check" manifold design, well known for its ability to increase the capacity of zeolite water softeners and to prevent loss of zeolite or exchanger, is used in these Elgin Deionizers. Where valuable resinous exchangers are used as required in deionization, the use of the "Double Check" principle is especially important.

Habitant Soup Co. Cuts Steam Costs 35% *with Preferred Units*





Here's what the Habitant Soup Co. of Manchester, N. H., reports: *"More than two years ago we installed two Preferred Unit Steam Generators and we're frankly amazed at the small amount of fuel they consume to produce more than enough steam for our requirements. In fact, they cut our fuel bills by 35%.*

"Maintenance of the Preferred units is practically nil because they are fully automatic. We're glad to report that both boilers are working like a charm."

There are a host of good reasons for these savings. Fuel costs go down, for example, because Preferred Unit Steam Generators offer fully automatic operation with inexpensive No. 6 oil. But Preferred units assure *even more* than appreciable, immediate returns on your investment. They are designed to give *continuing economical* operation for at least 25 years.

For proof, read the 25-year features in the panel at right. For full details, send for Bulletin 1000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

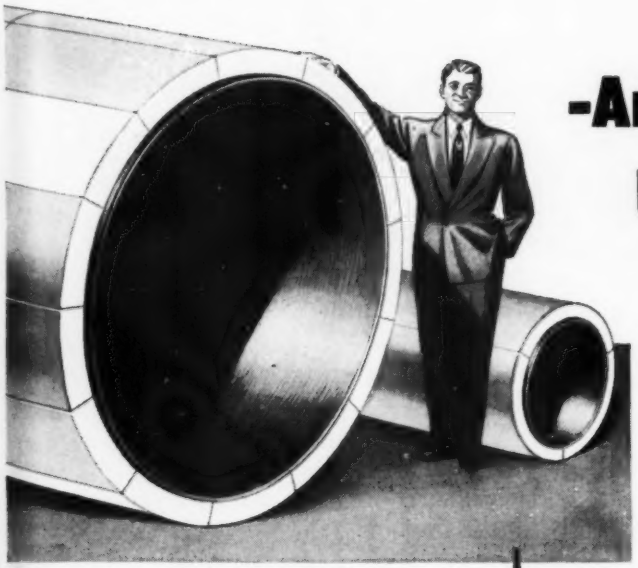
8 PREFERRED 25-YEAR FEATURES

- **4-pass, high velocity, gas travel—minimizes tube cleaning maintenance by self-cleaning action.**
- **Staggered tube construction — minimizes the possibility of tube pitting, even at low firing rates.**
- **Preferred-built 4700 rpm Horizontal Rotary Oil Burner—assures fully automatic operation even with No. 6 oil.**
- **Anti-stress deck for tube sheet protection.**
- **Self-cleaning *induced draft* fan with air cooled shaft and bearings—built to last 30 years.**
- **Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.**
- **Special *precipitator* developed by Preferred as aid to safe and clean operation.**
- **Dual purging cycles for positive elimination of gas stratification.**

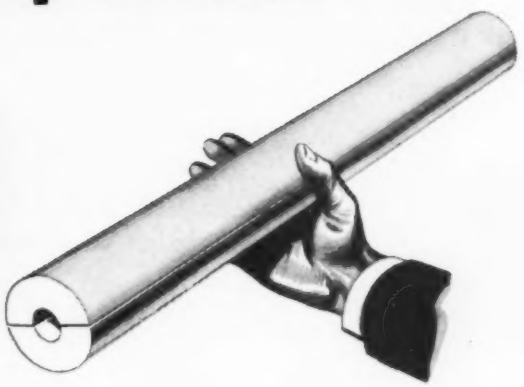
FR-191

PREFERRED UTILITIES MFG. CORP.

ONE PIPE INSULATION FOR PIPE SIZES ½ TO 72 INCHES



-And Temperatures Up to 1200° F.



SECTIONAL
Pipe sizes from ½" to 12".

TRI-SEGMENTAL
Pipe sizes from 8" to 23".

QUAD-SEGMENTAL
Pipe sizes from 19" to 41".

K-SEGMENTAL
For pipes, vessels or tanks from 38" to 72" in diameter.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses, diameters and shapes for snug nesting, when necessary. O. D.'s of insulation correspond to O. D.'s of standard pipes. All sections are 36 inches long. Single-layer thicknesses range from nominal 1" through 4".

Here is one proved pipe insulating material that is efficient throughout a wide temperature range—up to 1200°F. Kaylo Pipe Insulation is a calcium-silicate material which is highly resistant to damage from water vapor or moisture. It retains its dimensional stability and efficiency in long service. It is not a glass product.

Kaylo Pipe Insulation is available for pipe sizes from ½ inch to 72 inches. It is made to close dimensional tolerances to assure proper fit for each pipe size and for all operating conditions. Higher strength and lighter weight make it easier to handle and apply.

It will pay you to investigate all of the advantages offered by Kaylo Pipe Insulation. Get the facts now.

KAYLO®

PIPE INSULATION AND HEAT INSULATING BLOCK

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division • Toledo 1, Ohio

SALES OFFICES
Atlanta • Boston • Buffalo • Chicago • Cincinnati • Houston • Minneapolis • New York
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SEND COUPON FOR KAYLO HEAT INSULATION LITERATURE

OWENS-ILLINOIS GLASS COMPANY
Dept. N-78, Kaylo Division • Toledo 1, Ohio

Gentlemen: Please send me descriptive literature on Kaylo Heat Insulation.

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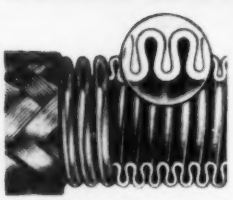
CITY.....STATE.....

For troublesome connections . . .

CMH
FLEXIBLE METAL HOSE offers the economical, dependable solution

Scores of troublesome connection problems where there is movement between parts, misalignment, vibration or expansion and contraction are effectively solved with CMH Flexible Metal Hose. Manufactured in a variety of types and a variety of metals, CMH Flexible Metal Hose is available for pressures from vacuum to 12,000 psi (burst) and for temperatures from sub zero to 1600° F.

If you do not already have literature describing the CMH line of flexible metal hose products, write for it, today, mentioning the types of connection problems you have.



CMH corrugated metal hose is manufactured in steel, bronze, stainless steel and other alloys and is available with or without metal braid covering. Convoluted hose, conduits, expansion joints, bellows and specialty items are also included in the CMH line.

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1335 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
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CMH

ONE DEPENDABLE SOURCE
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Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
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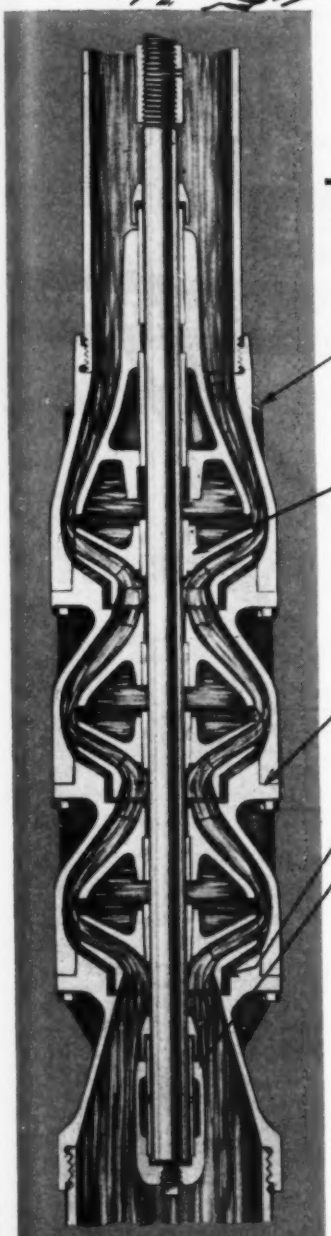
RE-DESIGNED...for a new high in Pumping Performance!

Worthington Type Q Vertical Turbine Pumps Climax Many Years of Continuous Development

Only the longest and broadest experience in the field could produce the Worthington Type Q Vertical Turbine Pump. New and exclusive casting methods, hydraulic and dynamic balanced impellers, and greatly improved bronze bearings are among the many features combining to give you the most efficient pumping performance at lowest possible cost.



Water-lubricated model illustrated

BOWL DESIGN-DETAILS

1. Discharge bowl construction of advanced type, providing most efficient conversion from velocity to pressure as liquid enters column. Oil-lubricated model includes new double-sealed construction for maximum protection.

2. Having made both enclosed and semi-open impellers for many years, Worthington now standardizes on enclosed. Advantages: up to 50% less down thrust . . . lighter loading of the thrust bearing and less shaft elongation, reducing sensitivity to changes in vertical clearance . . . elimination of extremely close vertical adjustment in the field.

3. Flanged type bowls for tighter joints, less corrosion, easier assembly, better alignment.

4. Renewable bronze wearing rings standard on all sizes except 6".

5. Large diameter shafts and extra long bronze bearings with sand collars at both ends of bowl assembly maintain rotor alignment, prevent vibration, assure longer life.

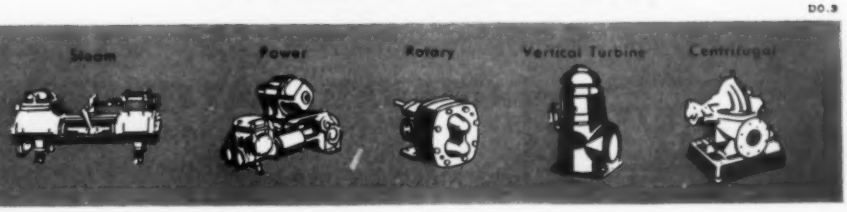
Available in sizes from 6" to 32", water- or oil-lubricated, Worthington Type Q Vertical Turbine Pumps handle liquids at temperatures of 7° below zero F to 500° F *with maximum head per stage over the entire size range.*

Contact your local Worthington dealer for the whole story that proves *there's more worth in Worthington.* Complete manufacturing and servicing facilities at Denver, Colo., and Harrison, N. J. *Worthington Pump and Machinery Corporation, Harrison, N. J.; Denver 16, Colorado.*

WORTHINGTON

DO.3

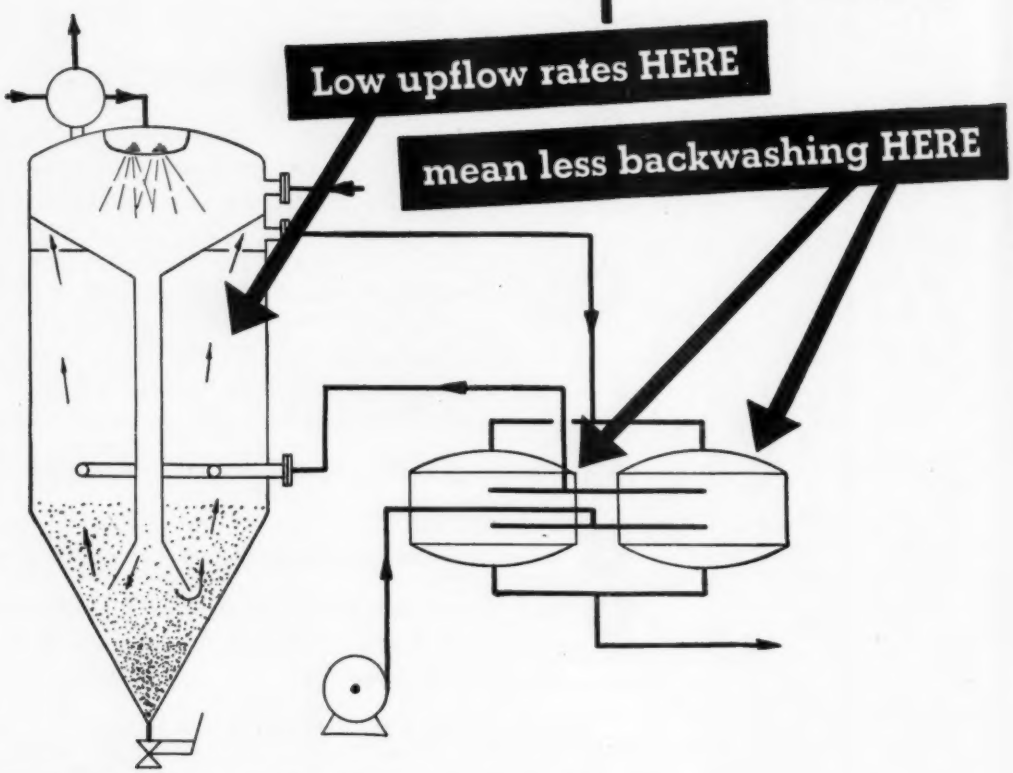
THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



Why GRAVER

HOT PROCESS SOFTENER FILTERS

Stay Cleaner



Among the many distinctive features of the GRAVER Hot Process Softener is the *low rising rate* of the treated water to the discharge after the softened water has passed through a dense bed of previously precipitated solids.

Compared to other hot process softeners, the GRAVER design provides as low as *half* the rising rate in a softener tank of given diameter and capacity. This means more efficient separation of precipitates and clearer treated water.

Therefore, the GRAVER Hot Process Softener is an effective *clarifier* as well as softener. It imposes less load on the filters . . . the filters stay clean longer . . . far fewer filter backwashings are needed . . . filter maintenance time and expense are greatly reduced . . . and in some instances, such as where a hot zeolite softener is used for second-stage treatment, filters may be unnecessary.

This principle of *more complete removal of precipitated solids within the softener tank* is one of many examples of GRAVER pioneering in water softener designs. For complete information on *all* the GRAVER Hot Process Softener advantages, write for Bulletin WC 102.

GW-427

GRAVER

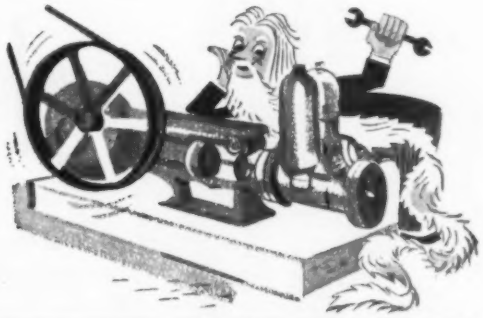
GRAVER WATER CONDITIONING CO.

216 West 14th Street, New York 11, New York, U. S. A.

A DIVISION OF GRAVER TANK & MFG. CO., INC. EAST CHICAGO, IND.

For thousands of years
Orientals have known ramie
as the long-lasting fibre . . .

Now . . . Johns-Manville
makes ramie fibre into
the long-lasting packing . . .



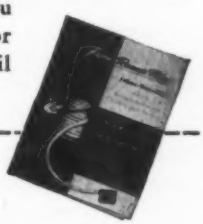
That's why *NAVALON* cuts packing costs to the bone . . .

IF YOU NEED A PACKING for reciprocating service that can take punishment and *last* . . . against fresh or salt water, brine, cold oil, and other cold liquids . . . try Navalon.

Navalon's long-lasting properties are inherited directly from ramie—a fibre that has been known for thousands of years for its strength and its rot-resisting qualities.

Because these long-lasting qualities of ramie—its high tensile strength and its rot-resistance—have been retained in Navalon, and because of a special Johns-Manville process that imparts unique lubricating properties, Navalon is consistently out-performing other packings in cold liquid service. In plant after plant, Navalon is standing up where other packings fail . . . reducing down time . . . and cutting packing costs to the bone!

If you have a tough packing problem, we suggest that you try Navalon. You can get it through your local packing distributor—or if you would like further details, write for folder PK-32A. Just fill in and mail the coupon below.



Johns-Manville
PACKINGS & GASKETS

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New York 16, N. Y.

Please send me your folder on Navalon Packing (PK-32A).

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Company_____

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City_____ State_____

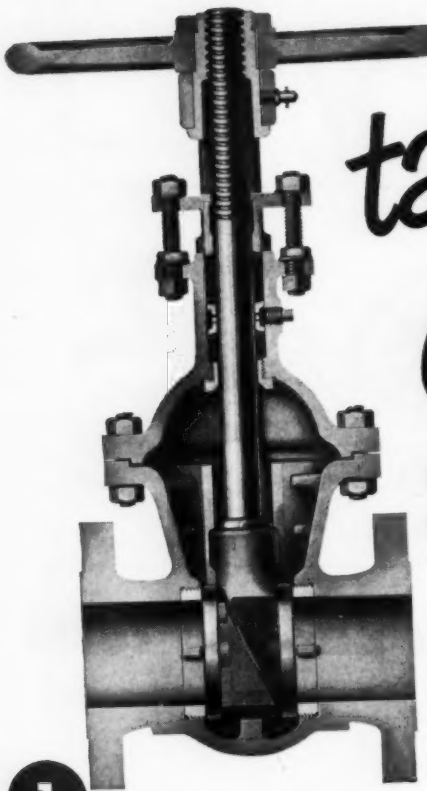
IP-8

PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

DARLING VALVES

take your choice...

FOR BETTER, LOWER COST SERVICE WITH DARLING cast steel gate valves



1

2

DARLING VALVES FOR EVERY NEED

Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds.

IN addition to gate valves of solid wedge design, Darling offers two other types. Both have distinctive features that prolong valve life while minimizing down time and maintenance. They're great time and money savers! . . .

1 This view shows a Darling gate valve of the fully revolving, double disc, parallel seat type. Time and again users rate it the most trouble-free, best performing gate valve obtainable today. Why? Because its unique design assures: *automatic* adjustment for valve body distortion . . . positive, easy operation . . . uniform wear distribution . . . foolproof simplicity in maintenance and reassembly . . . and service life seldom if ever equalled.

2 Take a close look at the slotted, double-grooved wedge in this cutaway view. There's little wear and tear on *these* wedge faces and seats because the slot permits compression of the wedge to compensate for valve body expansion or contraction due to temperature changes. Moreover, the double grooves, with twin guide ribs in the valve body, provide twice the usual bearing area, eliminating wedge canting and avoiding damage to the downstream seat.

SEND FOR BULLETIN

Why not get *all* the facts on these money-saving valves? Then *you* can analyze and decide whether or not you stand to gain by giving Darlings a try. Simply specify your service requirements . . . or ask for cast steel valve bulletin.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

INDUSTRIAL POWER

August, 1950 Vol. 59, No. 2

Editorial

CO-OPERATIVE RESEARCH

MANUFACTURERS and industries have always sought to improve their products. They have always sought to develop new ones. Not too many years ago, the approach was entirely empirical—all the emphasis was on "try-and-see" operations based on intuition and know-how.

Productivity of mere inventiveness, with emphasis on mechanical ingenuity, began to fade at the beginning of this century. And as it began to fade, organized science began to become effective in promoting industrial progress. Today, research is big business. About one billion dollars is spent annually in industrial and government laboratories, by universities and by research foundations.

It is claimed in many quarters that a billion dollars a year for research is insufficient; that it should be about two billions if the optimum welfare of our country is to be maintained in peace and war. This claim is based on fact: several industries have demonstrated that an average expenditure of two per cent of their gross sales on research leads to the maximum in quality and quantity of goods produced, as well as maximum profit. Parallel expenditures by all industry would attain the two billion dollar figure.

C. C. Furnas, director of the Cornell Aeronautical Laboratory, has often emphasized the problems involved in industrial research. Included is the fact that many industries, particularly small and medium-sized ones, have no research in the modern sense of the word. Others have practically none. They are vulnerable because they can't keep up with the procession. And where industrial research laboratories do exist, the following three important items for successful operation are often disregarded.

1. Research should be in a relatively autonomous position. It should exist and contribute in its own right; it should be parallel and not subservient to sales, production or engineering.

2. It must be conducted at a relatively constant level, providing continuity of effort and reasonable security to the staff. No research program will be successful if its budget follows violent fluctuations of business cycles.

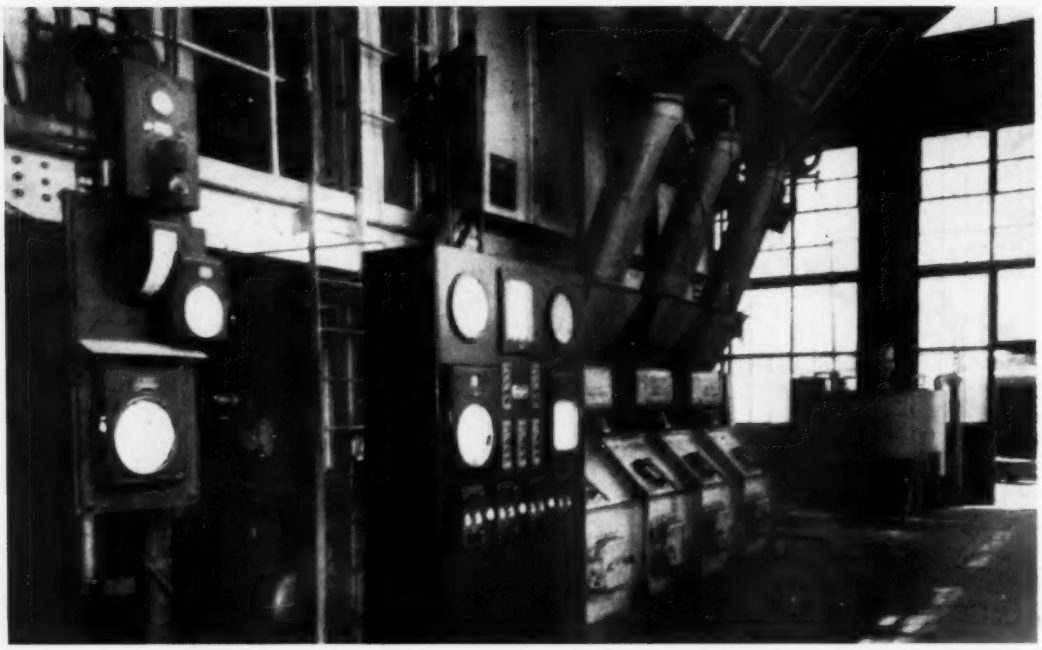
3. The research man must have freedom and opportunity for individual action. Research cannot be confined to a strait jacket of rigid regulation and rules or it becomes unproductive.

Scientific knowledge on which industrial research is based is so vast and its various categories so specialized that only the largest corporations can hope to support modern research organizations. This indicates the need for greater support of research foundations by small and medium-sized industries. They could, and should, give more support to fundamental research programs of colleges and universities.

Too often when small industries support research foundations and university research programs they expect immediate practical benefits on particular projects. To say the least, that is shortsighted.

Research has become such a predominating factor in the American way of life that industry, both large and small, cannot afford not to give it maximum support. This is not to say that there would be any danger of the pool of knowledge of scientific research and development drying up. The general social trend is such that if free enterprise doesn't support basic research, government will. In fact, this phase of socialization has probably advanced as far as is safe for our future sound economy.

William J. Hargest, Editor



Recently installed cross-drum, water-walled boiler floats on line as original boilers are base loaded

STOKELY FOODS, INC. REDUCES COST OF STEAM 33 CENTS PER 1,000 LB

After an extensive survey, instead of greatly increasing steam capacity, this company added one new boiler and changed over to alternating current to improve efficiency from 62 to 78.2%. Even higher efficiency is expected when the plant is 100% completed

J. P. RUTLEDGE, *Development Engineer*
Stokely Foods, Inc.

AFTER an extensive survey of the Stokely Foods, Inc., plant in Indianapolis, engineers found the over-all power plant efficiency was only 62%. Analysis also indicated the boiler house was not the full cause of this low efficiency, but that non-condensing turbines driving d-c generators were very inefficient. A careful study of two possible solutions was made, namely; (1) installing enough boiler capacity to take care of all processing needs and installing additional d-c generating equipment; and (2) installing one boiler to take care of the increasing processing needs, purchasing alternating current, at 4,160-v, from the local utility and reconverting the entire plant to a-c operation. The latter system was deemed more efficient.

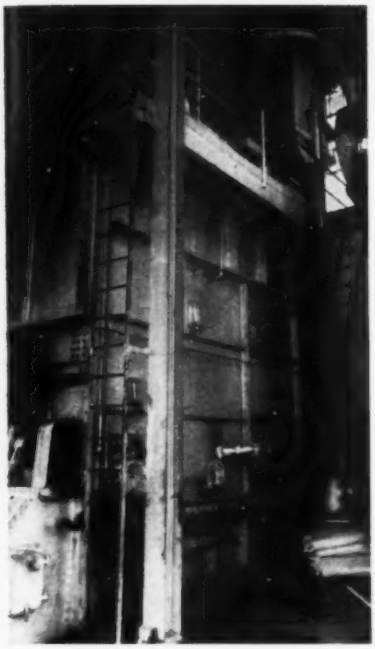
Furthermore, cost of two additional boilers, necessary coal and ash handling equipment, and increased water treatment plant would have been prohibitive. The new system is now in operation and boiler house efficiency has increased to 78.2%. Cost of 1,000 lb of steam has been reduced 33 cents.

One water-wall integral boiler, having a total heating surface of 5,860 sq ft, was placed into operation alongside the two original boilers early this year. This boiler has a capacity of 50,000 lb of steam per hr and is operated at 150 psi, saturated. The furnace volume is 2,050 cu ft, and a spreader stoker, with a grate area of 126 sq ft, is automatically controlled. In addition an integral economizer, having a heating surface of 975 sq ft, maintains the feedwater at 212 F.

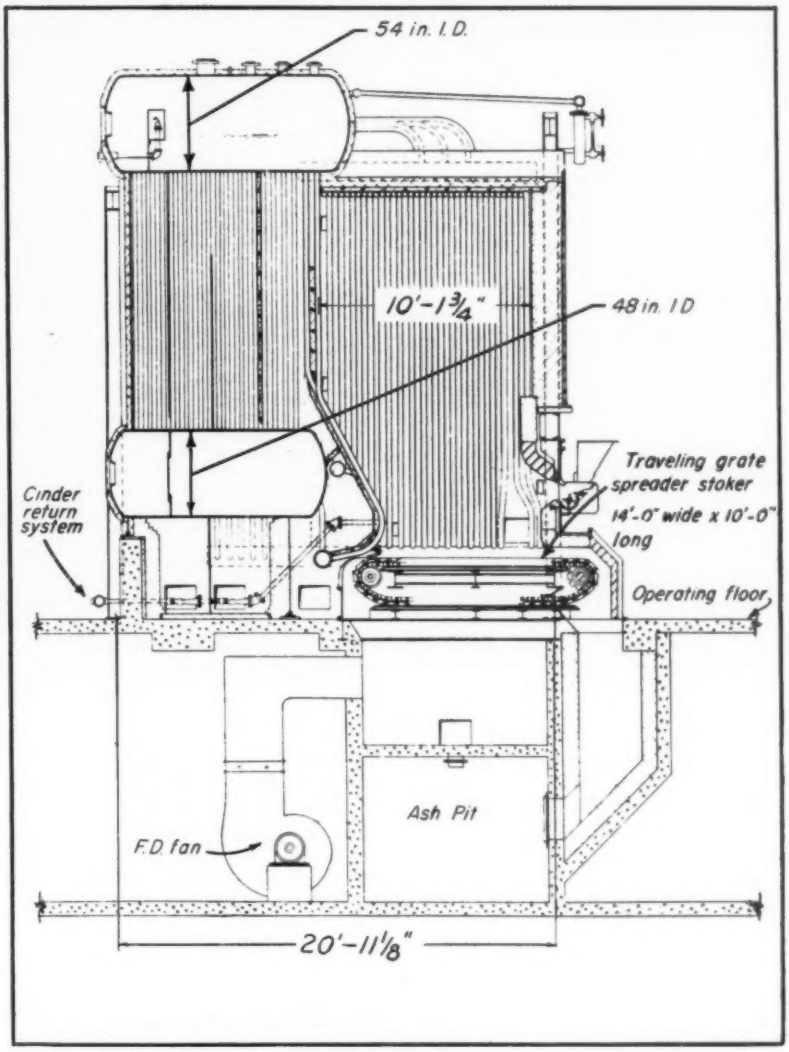
Overfire air, drawn from the ash pit, is blown into the furnace at low pressure, and smoke is held at the minimum. The two original boilers will operate at base load, while the new boiler will float to effect a good steam balance.

Coal Handling

Indiana coal is delivered by rail and unloaded over a track hopper. Dumped coal is lifted by means of a bucket conveyor to an overhead bunker, which has a capacity of 70 tons. Coal drops from this bunker through a meter into individual spouts leading to boiler coal hoppers. Each boiler has three separate spouts leading to the stokers. Entire coal feeding system is controlled automatically. This in itself has increased operating efficiency considerably.



Economizer aids boiler efficiency by maintaining boiler feedwater at 212F



Fly ash trapped in dust collector is picked up by an ejector system and returned to the fire box. The ash drops into the ash pit and it is removed mechanically

Induced and forced draft fans run continuously because of the high resistance offered by the dust collectors, economizer and stack. Flyash is trapped in dust collectors and picked up and returned to the ash pit by means of a high pressure ejector system. Soot is blown twice daily, and smoke is kept at the minimum at all times.

Steam is distributed to processing and turbine operated equipment at 150 psi. These turbines are non-condensing and exhaust at 2 psi back pressure. High pressure steam is reduced through a pressure reduction station to 5 psi, which is necessary for food processing. The heating system, operated at 2 psi, is made up of non-condensed steam from the processing units and turbines.

Make-up Water

Make-up water for the plant is exceptionally high, in fact in the summertime 90% is required. This high amount of make-up is caused by contamination of steam as it comes in contact with sealed cans in the cooking process. There is a certain amount of food spillage on the side of the cans when they are filled. This spillage is washed off in the submerged heaters, and therefore the hot water removed from the autoclave is wasted. In this heating process, hot steam is injected directly into the heater. In such a method, the steam not only acts as a heating agent but a mixing agent to maintain an even water temperature.

PRINCIPAL EQUIPMENT IN STOKELY FOODS, INC. PLANT

Boiler	Riley Stoker Corp.
Integral economizer	Riley Stoker Corp.
Spreader stoker	Riley Stoker Corp.
Coal handling equipment	Fairfield Engineering Co., The
Combustion controls	Hagan Corp.
Boiler feedpump	Dean Hill Pump Co.
Boiler feedpump turbine	Dean Hill Pump Co.
Boiler feedpump motor	Crocker-Wheeler Electric Mfg. Co.
Soot blowers	Diamond Power Specialty Corp.
Flow meters	Republic Flow Meters Co.
Overfire air fan	Clarage Fan Co.
Overfire air fan motor	Crocker-Wheeler Electric Mfg. Co.
Induced draft fan	American Blower Corp.
Induced draft fan motor	Crocker-Wheeler Electric Mfg. Co.
Forced draft fan	American Blower Corp.
Forced draft fan motor	Crocker-Wheeler Electric Mfg. Co.
Switch gear	I-T-E Circuit Breaker Co.
Plug-in bus duct	BullDog Electric Products Co.
Motor generator sets	Westinghouse Electric Corp. General Electric Co.
Air compressors	Worthington Pump and Machinery Corp.
Air compressor motor	Reliance Electric and Engineering Co.

During the winter make-up runs between 30 and 40% because of the returned condensate in the heating system. Originally steam at 150 psi was delivered to two non-condensing turbines, which drove a 500 and a 350-kw d-c generator. Current was developed at 280-v, and these units supplied all the necessary power to drive the d-c electrical equipment throughout the powerhouse and processing units located in the plant.

Steam Balance

As these turbines were non-condensing it was impossible to have a proper steam balance. In the new system dual operated processing and powerhouse equipment has been installed. This consists of an electrical driven and turbine driven unit. To insure a good steam balance, the turbines are placed into operation whenever there is a surplus of steam.

To start the changeover, two motor-generator sets, 500 and 300-kw, were installed and connected to the purchased power supplied. These d-c generators were connected to the old plant electrical distribution system, and d-c operated apparatus continued uninterrupted. However, a temporary 220-v a-c three-phase line was installed, and a-c equipment was tied in as the replacements were made. The new electrical equipment will be 220/440, three-phase, 60 cycle and all permanent bus duct equipment being installed will be 440-v. An analysis showed that it would be cheaper to run in the temporary 220 v line, as some equipment had been operated at this voltage.

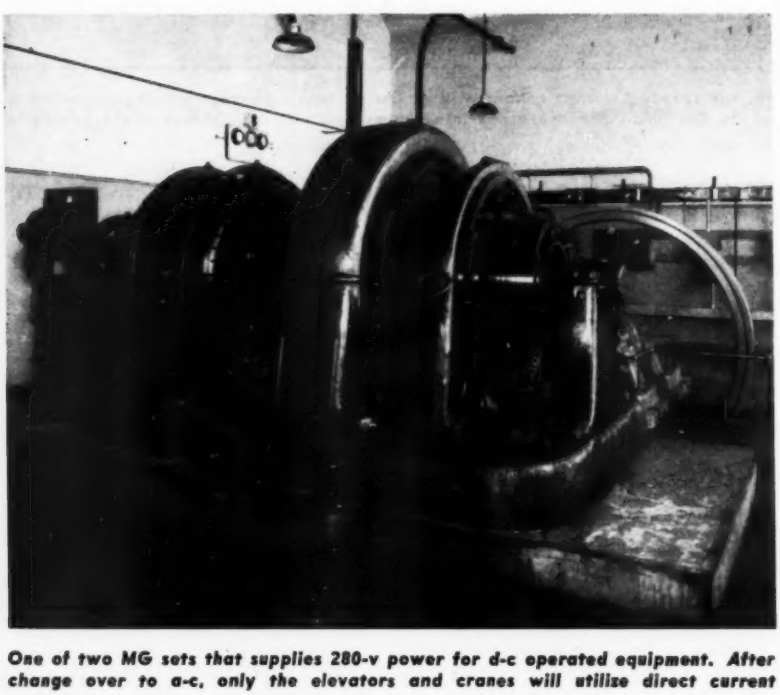
At the present time 440-v plug-in bus ducts are planned for each floor of the building, and all 220-v equipment will be eventually connected to this duct. As all electrical equipment purchased to date is 220/400-v, it will be a simple matter to change the 3 phase motor wiring to accommodate this higher operating voltage when completed.

TABLE 1—PREDICTED PERFORMANCE DATA

1. Steam output, pounds per hour	15,000	45,000	50,000
2. Furnace liberations, Btu per cu ft per hour	9500	28,900	32,400
3. Excess air at boiler outlet, %	53	35	35
4. Coal, pounds per hour	1,720	5,240	5,880
5. Air, pounds per hour	22,500	60,500	68,000
6. Air, cfm	5,100	13,700	15,400
7. Steam pressure at boiler outlet, psi	150	150	150
8. Feedwater temperature, F	212	212	212
9. Air temperature, F	80	80	80
10. Exit gas temperature, F	435	590	620
11. Draft losses, in. of water			
Furnace draft	0.1	0.1	0.1
Boiler draft	0.1	0.7	0.9
Dust collector (Bubar)	0.05	0.3	0.4
Outlet damper and flues	0.05	0.4	0.5
Total draft	0.3	1.5	1.9
12. Air resistance, inches of water			
Air duct	0.1	0.5	0.6
Grate and fuel bed	0.2	1.3	1.5
Total resistance	0.3	1.8	2.1
13. Heat balance, losses %			
Dry gas	10.17	12.90	13.65
Hydrogen and moisture in fuel	5.33	5.64	5.70
Moisture in air	.25	.31	.32
Unburned combustibles**	1.30	1.50	1.60
Radiation	2.95	.95	.83
Unaccounted for	1.50	1.50	1.50
Total loss	21.5	22.8	23.6
14. Efficiency of dust collector, %	90	85	80
15. Efficiency of unit	78.5	77.2	76.4

16. Steam quality—Not more than ½% moisture with boiler water concentration less than 3500 ppm.

** Based on reburning dust collector fly ash.



One of two MG sets that supplies 280-v power for d-c operated equipment. After change over to a-c, only the elevators and cranes will utilize direct current

Purchased Power

Purchased power is received at 4,160-v and stepped down in a transformer bank to the necessary 440-v. At the present time with the temporary 220-v bus duct, further stepping down of power is necessary. This, of course, is only a temporary measure and will be eliminated when the system has been changed. Main service, as planned, will be 2,000 amp throughout. The only remaining units to operate on d-c will be the elevators and cranes. Lighting service is supplied through individual transformers located on each floor, and it will be stepped down to 110-v. When necessary, fractional hp motors will be tied into this same 110-v circuit.

Total demand of treated water, for processing and steam, is 1,200 gpm. Daily consumption, which includes processing, steam and cooling water, is 1,700,000 gal. Of this only the city water is treated as the hardness is only 15 to 17 gr as calcium carbonate. The well water has an average hardness of 32 gr as calcium carbonates, and in addition it contains considerable amounts of iron, which would not be desirable for food processing. Therefore, this water is used only for cooling purposes while the treated city water is used for actual food processing.

Engineering and Construction Problems Involved in Designing • • • •

THE HUEY GAS-TURBINE

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And

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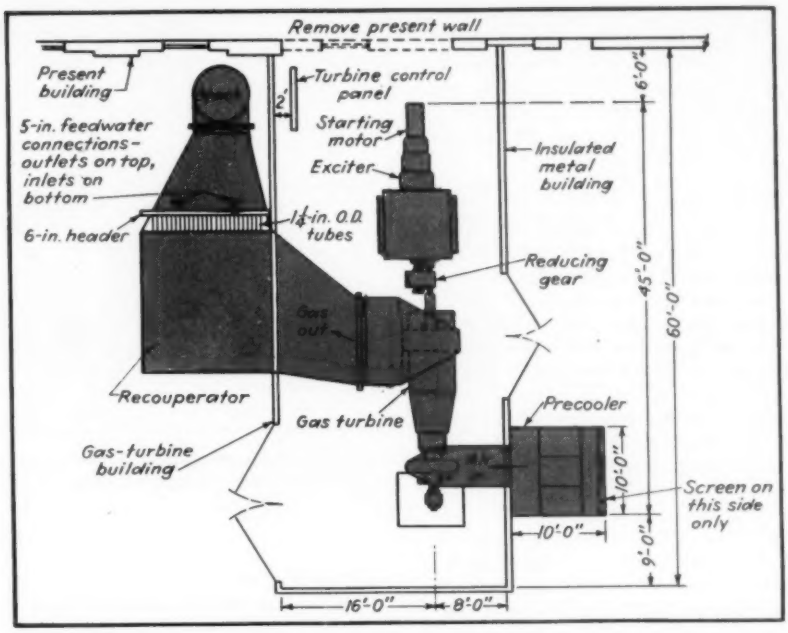

Fig. 1—The building houses only the gas-turbine generator and controls. Precooler for the compressor and recouperator for heating feedwater stand outside

Fitting a gas turbine into the heat cycle of the Huey Station of the Oklahoma Gas and Electric Co.* produced a 7,000-kw gain in plant capability — 4,000 kw from its generator, and 3,000 kw by releasing extracted steam formerly used for feedwater heating

HUEY STATION originally went into operation in 1930 with one 30-mw turbine-generator and three 150,000-lb-per-hr, 400-psi and 750-F boilers originally designed for coal firing. But since gas was readily available from the Oklahoma City area, coal-burning equipment was omitted and gas-burning facilities installed with a standby oil system.

During the war a 20,000-kw turbine-generator unit of conventional design was installed. This utilized the total boiler capacity equivalent to 51,000 kw while the turbines had a combined capability of 56,000 kw. Since the post-war system demand increased more rapidly than expected, it was essential that additional economical capacity be installed as quickly as possible.

Several proposals were considered for making up the deficiency in steam generating capacity, and for making available the additional 5,000 kw from the turbines as follows:

1. Installation of another boiler. The increasingly high cost of large boilers and slow delivery made this proposition unattractive for the immediate situation.

2. Supplying steam from external sources for heating feedwater.

3. Installing a gas-fired feedwater heater.

4. Installing a simple-cycle gas turbine operating on natural gas and equipped with an exhaust-gas recovery heat exchanger for feedwater heating.

All propositions except the gas turbine installation would increase the capability desired, but sacrifice station heat rate. Therefore, in February 1948 a nominally rated 3,500-kw locomotive-type gas-turbine unit equipped with an air precooler and gas heat exchanger for heating the steam plant feedwater was purchased (INDUSTRY AND POWER, Dec. 1949 pp 90). Studies showed this combination would result in a 7,000 kw gain in plant capability—4,000 from the gas-turbine generator and 3,000 by releasing extracted steam formerly used for feedwater heating. As original station installation was designed by Byllesby Engineering & Management Corporation, now the Pioneer Service & Engineering Company, the task of designing the gas-turbine extension was assigned to that company.

General arrangement of the gas-turbine installation is shown in Fig. 1. The air precooler, recouperator for feedwater heating and stack are located outside, Fig. 2. Operating level is the same as that in the main plant turbine-room basement so the unit can be attended by the existing operating forces. A 10-ton manually-operated overhead crane with power hoist was installed in the gas-turbine house to service the unit.

The unit's foundation contains about 126 cu yd of reinforced concrete. Since the installation was made at ground level, considerable excavation was required to put the turbine lubricating-oil tank into position below the governor end of the turbine. Also, the generator leads, generator cooling-water and fuel piping were brought in under the floor.

Connections to the existing station for feedwater, electrical facilities and service water were made in the conventional manner. Fig. 3 is a one-line diagram showing an extension from the main boiler feed discharge header through the exhaust-gas recouperator and back into main feedwater system.

A 4,000-kw, 0.8 pf, 13.8-kv, 3,600-rpm generator, which was slightly oversize for the nominal rated 3,500-kw turbine, was selected. Subsequent operation at 5,000 kw during cold weather justified this choice. Generator output goes by cable through an underground duct run to the ocb in the main sub-

*Abstract of a paper presented at the ASME Semi-Annual-Meeting in St. Louis, Mo., June 19—23, 1950.

station for distribution or step-up to the 66-kv transmission system. Electrical requirements for auxiliary equipment, such as the 250-hp starting motor, oil pumps, and cooling-water pump, come from the existing station power supply at 2,300 and 440 volts.

Service-Water Supply

Arrangements of service and well-water facilities for the gas turbine extension provide for using the existing steam plant service-water supply to the oil and generator-air coolers. The generator air cooler was purchased for 95-F water. Since the main plant service water is taken from the lake, which is used for condenser cooling and may go to 105 F in the summer, a vertical service-water pump (400 gpm, 75-ft head) was installed in the base of an existing cooling tower to provide 90-F water to the generator-air and oil coolers under adverse conditions of loading and water-temperature rise.

This piping arrangement also provides for supplying 63-F water from deep wells to the precooler in the gas-turbine air compressor inlet during hot summer days. The latter provision results in an increase of some 630 kw in capability of the gas-turbine unit, with an average of 225 kw.

Recouperator Design

Considerable study was given to the most practical and economical arrangement for the recouperator, which uses heat from the turbine exhaust to heat feedwater for the boilers. Consideration was given to a gas-fired heat exchanger that could be used when the gas turbine was out of service or to augment waste heat from the gas turbine. Also, designs were considered for passing the full station feedwater requirements of some 600,000 lb per hr. The recouperator finally purchased is designed around the following specifications:

Water flow	350,000 lb per hr
Gas flow	344,000 " " "
Gas temperature, inlet	780 F
Gas temperature, oulet	324 F
Water temperature, entering	185 F
Water temperature, leaving	295 F

Since the gas-turbine compressor handles air at constant volume, there is obviously a reduction in capacity during high ambient temperatures in the summer because fewer pounds of air are handled. Calculations proved, however, that using three sections of discarded finned-tube generator-air coolers, supplied with well water, would effect a gain of 750 kw in gas-turbine capability (26%) when ambient temperature was 100 F.

Three cooler sections, having an effective surface of 30,000 sq ft, were rebuilt and installed vertically with the inlet and outlet heads at the bottom of the compressor inlet just outside the building. They were designed to handle more air in their original location on the generator than would be required for the gas turbine, hence the drop through the air side with 328,000 lb of air per hour was found to be less than one inch of water.

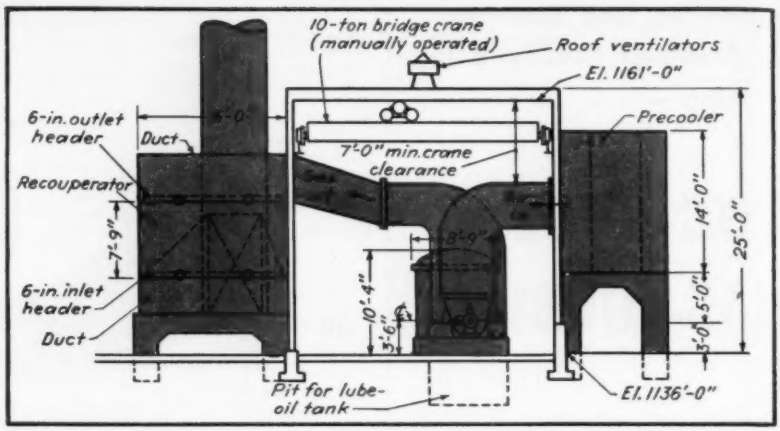

Fig. 2 — Operating level is the same as main turbine-room basement so unit can be attended by regular crew. A 10-ton crane serves for maintenance work

The air coolers would be supplied with from 400 to 700 gpm of 60 to 65-F well water as required, with very little temperature rise. Return from these coolers, therefore, is piped so the cool water can still be used in the existing plant service-water system for critical cooling.

Cooling-water requirements for the gas turbine proper were specified as follows when supplied with water having a temperature of 95 F.

Generator air cooler	120 gpm
Turbine oil cooler	200 gpm

Fuel Booster

The manufacturer requires 150-psi natural gas to be available at the gas turbine to insure full output under most adverse conditions.

The station is located on the main transmission system of the gas company and the gas pressure seldom drops below 150 psi. But to insure operation, a gas booster was installed in the fuel supply line. For this purpose we selected a motor driven rotary compressor operating at 690 rpm and capable of compressing 100,000 cu ft per hr from 100 psi intake to 170 psi discharge.

The compressor is equipped with a 75-hp motor and is designed for outside service with no protective covering or water cooling. It is located at the main gas regulator station about 600 ft from the turbine. Starting is automatic at a predetermined suction pressure and shutdown occurs when the main line pressure reaches 170 psi.

For maintenance and emergency requirements, manual control extends to the cabinetrol in the gas-turbine building for starting and stopping. An automatic relief or bypass valve in the gas-compressor discharge has its outlet piped to the low-pressure gas-fuel supply line to the boilers. Provisions were made for installing a cooler in this bypass line if required.

In addition, an emergency shut-off valve in the gas line to the gas turbine can be tripped at the control panel, and in the main steam plant.

Since the recouperator was sized to take only part of the feedwater requirements, the piping was connected so feedwater could normally be routed through the recouperator in parallel with the extraction heaters, Fig. 3. This also permits 100% flow through the recouperator on light steam loads.

To obtain the maximum over-all economy, the feedwater control was set up on a two-stage basis for operating the diaphragm valves from a temperature element in the feedwater adjacent to the boilers. Second stage, or bias to the feedwater temperature, is originated from steam temperature in the manifold supplying the two main turbines. This control arrangement can be adjusted to hold a constant steam temperature between 690 and 760 F and feedwater temperature in the range of 240 to 320 F.

Pressure-Drop Studies

Head capacity characteristics of the existing boiler feed pumps were established for the original installation. Thus it was necessary to study feedwater pressure drops through the recouperator and control valves in the feed-line to assure adequate pump capacity with the new equipment.

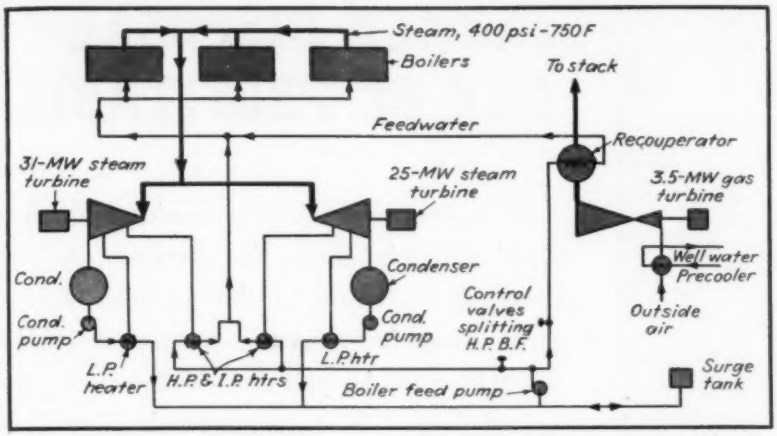

Fig. 3—Feedwater flow from boiler-feed pumps splits to go through extraction heaters and gas-turbine recouperator to cut down the use of extracted steam

Arrangement of air and gas ducts to and from the gas turbine is shown in the general layout Fig. 1 and 2. The intake duct between air precooler and compressor inlet is equipped with a silencer, guide vanes and a fabric expansion joint in the vanes and a fabric expansion joint in the vertical run above the compressor. These suppress noise in the surrounding area.

Maximum allowable thrust on the turbine exhaust is limited to one thousand pounds. Due to the complicated shape of the exhaust duct, its rigid connection to the recouperator and necessity for supporting the duct under the crane, numerous problems were encountered in working out a satisfactory flexible connection between exhaust duct and gas-turbine outlet. The original bellows-type expansion joint arrangement did not work out since single joints of this type cannot take shear. Best solution appears to be a fabric joint that can stand 800 to 850 F, which is being fabricated.

Starting Arrangement

Insulation is installed on both air-inlet and the gas-outlet ducts as well as around the recouperator.

In adapting the railroad-design unit to stationary service a different method of starting it was required. For this installation, a 250-hp wound-rotor induction motor was installed to turn the unit at one-eighth speed for purging, and up to about one-half speed for firing. It drives the unit through a speed increasing gear and is connected to the main shaft by a jaw clutch.

The motor does not develop enough break-away torque to start the main shaft turning; so it was necessary to build a turning gear into the main reduction gear. This also permits rotating the unit slowly for maintenance inspection and cooling at shutdown.

Lubrication is by a simple pressure-fed system, with a 1,200-gal tank containing the cooler and pumps. A turbine driven pump serves the unit during operation and a motor driven one takes care of starting and stopping. Emergency shutdowns are handled by a d-c motor driven pump. Bearings are pressure-fed, babbitt-sleeve type.

Protective Devices

To make the unit completely automatic in starting and operation required numerous protective devices. These are of two types. The first type causes immediate shutdown of the unit on:

1. Fuel failure.
2. Low lube-oil pressure.
3. Flame failure.

Preliminary warning alarm is sounded and, if the fault is not cleared, the unit is shut down by:

1. High exhaust temperature.
2. High bearing temperature.
3. Excessive vibration.

The installation is completely insurable and is protected by normal insurance coverage. At present, insurance underwriters have not established a definite rate for this type installation, but are setting up standards.

Installation of the machine duplicated, in many respects, the procedure used on steam-turbine-generator erection. The generator, gear, exciter and oil tank are of standard steam-turbine design. The gas turbine was shipped completely assembled, ready to be set on its foundation.

Turbine Support

Due to its unique design, the turbine is held rigidly in line at only two points. The main and fixed support is located aft of the turbine casing (reducing-gear end) and is called a ball support. This is a ball joint that anchors the aft end of the unit in position and forces all expansion (about ¼ in. at full load) forward. To prevent side and twisting motion, the turbine is supported at its center by two hinged trunnions. A key and set of gibs on the bottom centerline of the unit keep it in line. The trunnion supports have spherical bearings at both ends so the turbine can expand freely.

Since the unit has only one solidly fixed point to hold it in place, a set of alignment fixtures was furnished as special installation tools. They were designed to allow complete controlled movement of the gas turbine in all directions during alignment.

When the aft end support and the trunnion supports were set, the alignment fixtures were removed. This left the gas turbine mounted on the aft end support and trunnion supports. The compressor section is cantilevered from the trunnion supports. The unit is designed so that it is rigid enough to support its own weight and hold itself in alignment as a unit. A spring loaded vibration dampener is installed under the inlet casing. Maximum vibration has been in the order of ½ mil.

Operating Data

It should be possible to install a unit similar to this in less than one month provided the building and foundation are completed and a full-capacity crane is available. The gas-turbine unit has given a good account of itself as indicated by operating data compiled in the table below.

OPERATING DATA AS OF JUNE 20, 1950

Date in service	July 29, 1949
Total hours operation	5923
Kwh generated	24,339,000
Average load, kw	4,110
Maximum load, kw	5,000
Average inlet air temperature, F	59.9
Average turbine exhaust temperature, F	785
Average flue gas to stack temperature, F	330
Btu per kw gas turbine only (HHV)	21,500
Btu per kw combination with steam, net (Plant)	15,361
Average plant pickup by combined operation during period covered above, kw	6,628
Plant pickup under favorable conditions	7,400
Station capability under most adverse conditions, kw	58,000
Cost per kw of combination capacity, under max. conditions, $	99

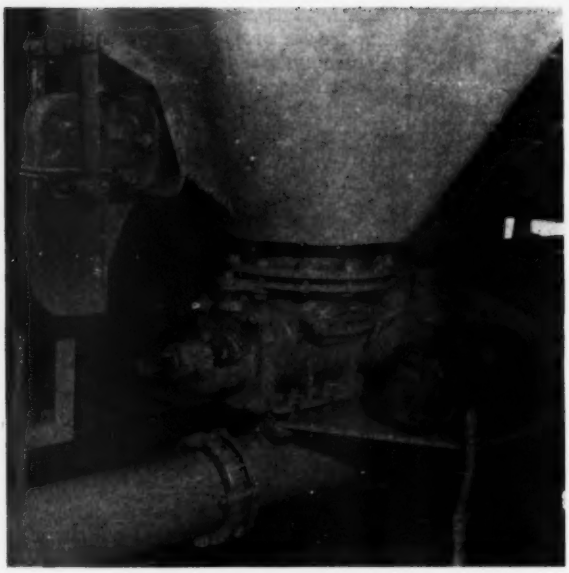

Fig. 1—Automatic vibrator loosens packed flyash so it can be moved easily to conveying equipment

FLYASH DISPOSAL CAN BE PROFITABLE

Recent developments and research into the disposal of flyash indicate that numerous applications can be found for this material. Equipment such as dust collectors, conveyers and additional bins can be paid for with the money received from it in a comparatively short time

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CONVERSION of flyash into a profitable by-product has long been the need of many utility and industrial plants. With continuing growth of pulverized coal and spreader stoker firing this need is becoming increasingly important. Then, too, the development of higher-efficiency flyash collectors, incidental to meeting public demands for reduction of air pollution, is resulting in more flyash collection from many of the newer furnaces. This is particularly true in an increasing number of utility plants where mechanical-electrical collectors with overall collection efficiencies in the high nineties are being installed.

The net result is cleaner gas to the atmosphere but more flyash for disposal. What to do with collected flyash has formed the basis for considerable research for nearly twenty years. A recent study disclosed at least twenty papers and articles on work that has been done in an effort to find a use for flyash. During this research at least thirty different products such as an inert filler, abrasive material, or natural cement were found.

Before discussing some of these applications let's look at the properties of flyash. The American Boiler and Affiliated Industries Lexicon defines it as the fine particles of ash carried by the products of combustion. Chemical composition produced from widely varied coal deposits varies principally only in carbon content.

Fig. 2—As flyash has not been exploited commercially, certain handling problems must be overcome. Scrapers in this rotary drum remove damp and packed material

A typical analysis shows silica (SiO_2), alumina (Al_2O_3), iron oxide (Fe_2O_3) and lime (CaO) as the principal constituents. In addition, small amounts of magnesium, titanium, sodium, potassium, sulfur, phosphorous along with some carbon are found in all samples. Finer sized flyash carries lower carbon content. This fact was revealed during studies for applications in concretes by R. E. Davis, consulting engineer of Berkeley, California, about ten years ago.

Three samples of flyash with an average of 2% carbon had an average of 90% of the particles passing a 325 mesh sieve, while five samples with an average of 22% carbon revealed only 70% of the particles passing a 325 mesh sieve. Flyash particles, which are generally spherical in shape, contain some pozzuolanic properties (ability to combine with lime and form a concrete-type product) similar to those exhibited by volcanic ash. This characteristic varies with carbon content and to some extent with particle size—lower carbon and smaller sized material showing better properties.

Studies on flyash usage have been directed along two principal channels: (1) substituting it for all or part of a material used in a product, and (2) development of new products that will utilize it as the principal ingredient. In order to gain acceptance as a replacement material, the finished-product properties should be improved or remain substantially the same as those imparted by the displaced material. Furthermore, the ash must be available at a price sufficiently attractive to make

the change profitable to the user and an economical disposal for the seller.

Many factors must be considered to realize this objective: (1) cost of handling, transporting and delivering the ash in a form needed by the user; (2) will the business be year-round, seasonal, or require stand-by storage during off-periods of usage; and (3) will modifications or additions to the consumer's normal basis of production be necessary.

Handling and transportation requires careful study because of flyash characteristics. Even though these factors do not directly influence the suitability of ash for specific use, they are necessary for proper analysis of the commercial feasibility of the end use. Flyash has the tendency to arch and hang up in collector hoppers.

Transportation Problems

When transported dry in open vehicles there is a substantial windage loss and resultant contamination of the atmosphere. It settles and packs during long hauls and unloading problems result. These conditions and problems can be largely solved through commercial equipment. For instance, automatic vibrators, Fig 1, are employed to break up arching and sticking and provide continuous free flow from hoppers. At this point air swept valves with special alloy piping can be operated to transport ash to storage hoppers. Transfer from such equipped hoppers to cars or trucks can be a dust-free operation by means of commercially available dustless unloaders.

Rotating mixing drums, Fig 2, are employed where water sprays are located. As the drum rotates a scraper bar mixes the ash with water and insures a continuous flow of dampened ash to the transportation vehicle. The resultant material is in good condition for dust-free disposal within relative short distances of the plant. For long-distance hauling in a dry state, covered hopper bottom cars, similar to those employed for bulk cement transportation, are being used.

There are nine companies manufacturing this type of car who will furnish either vibrator brackets or ports for air lances. These built-in devices help break up any packing that occurs during transit and insure a free, continuous discharge. For example a portable pneumatic pump for unloading from a truck is now available, Fig 3.

Some of the uses of flyash that have been covered in research and the results of these studies are:

1. Fuller's earth replacement in rubber. This outlook is not encouraging because the ash is not sufficiently fine, and in the case of light-colored products caused unfavorable discoloration.

Fig. 3—Problem of packing and sticking of flyash during bulk transportation is quickly remedied by portable pneumatic unloading devices, such as in foreground

2. Substitution for pumice in mechanic's soap. This application gave satisfactory abrasive qualities. In some cases, however, it yielded a soap of questionable color that might adversely influence consumer acceptance. When used in a metal polish the extremely fine material was not sufficiently abrasive. Questionable value as a replacement material and a small potential market for such uses has discouraged additional studies.

3. Filler for replacing calcium carbonate in primer paints. Although some success has been reported, other studies revealed poor covering power and objectionable color for certain applications.

4. Replacement of sand in fertilizer. Although results were satisfactory, the low cost of spent foundry sand precluded the possibilities of a profitable sale for this use.

5. Limestone or silica dust substitute in asphalt paving. Results have been quite satisfactory and this use is continuing in several sections of the country. The texture of flyash sheet asphalt wearing surface can be made very smooth when hand laid and later rolled, Fig. 4.

6. Combination with by-product materials from oil refineries and coke ovens gave bituminous products suitable for road construction.

7. Sandy soils have been treated with flyash because of its calcium, potassium and phosphorous content. Tests with cereals did not show any improvement in rate of growth or size of crops.

8. Sandblasting on condenser tubes and turbine blades has given high polish with low loss of metals.

9. It has been used in cinder concrete for reducing the porosity. Low porosity is particularly advantageous when the concrete is used with steel because it minimizes seepage of water,

Table 1—TRANSPORTATION AND END USES OF FLYASH (Results of Survey Conducted in 1948-1949)

Method of Transporting	Utility or Industrial Plant																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Bulk:																																					
RR Cars		•			•			•																							•					
Trucks	•		•			•	•			•	•							•	•		•			•	•		•	•		•				•	•	•
In bags:																																					
RR Cars			•		•																										•					
Trucks			•		•																										•					
Sluice or pumped				•			•	•				•		•	•					•	•	•			•	•	•					•	•				
Barge															•																						
End Use of Flyash																																					
Fill or accumuate	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Dumped in ocean															•																						
*Mineral Filler		•																													•					
*Abrasive		•																													•					
*In asphalt paving		•														•															•					
*Admixture in concrete		•																													•					
*Pozzuolanic material		•																													•					
*Bricks					•																																
*Building blocks								•																													
*Cinder blocks								•																													
*Concrete pipes					•						•																										
*RR Grouting					•						•																										

*Quantity used for this purpose represents only a small percentage of the total flyash collected at plant

which attacks steel through oxidation.

10. Road building blocks have been cast from fused flyash and were found to be too friable in road service. Although proper heat-treating would probably yield high-strength blocks, production costs in the majority of cases did not appear favorable.

11. The ash has been used for filtering crankcase and dirty transformer oils. Fuller's earth proved to give much better performance.

12. Adding flyash to putty and caulking gave good results as to texture, but discoloration of the product appeared to be a factor that might retard consumer acceptance.

13. Pressure - molded, steam - cured "ROSTONE" blocks contain 90% flyash. The proportions of different materials in these patented blocks are: 100 parts flyash, 10 parts hydrated lime, 0.5 part resin and 19 parts water. These celled blocks are 8 x 8 x 16 in. in size and weigh about 23 lb with 55% of the volume taken up by cells. Resistance to freezing and thawing is about the same as that of burned clays.

14. Flyash as a replacement for portland cement in mortars and concretes has received extensive study. Some of the best findings are found in "Properties of Cements and Concretes Containing Flyash" by Raymond E. Davis.

Fig. 4—Flyash as a substitute in asphalt topping produces a smooth road surface. Asphalt is laid and hand tamped before final mechanical rolling operation

This report reveals that moderate percentages of flyash as a replacement for cement will produce concrete that exhibits qualities equal, and in some respects superior, to concrete without flyash. For instance some flyash concretes exhibit substantially higher compressive strength and greater impermeability at later ages, and greater resistance to sulfate action than concretes without flyash. At Hungry Horse Dam, now under construction in Montana, they will use 140,000 ton of flyash in producing 3,000,000 cu yd of concrete.

Recently a survey was made to determine what companies are now doing with their collected flyash. This investigation was confined principally to public utilities because of the large amounts collected and their long, continuing efforts to find a large scale, year-around use for this by-product. Furthermore, such plants are located close to industrial areas where the maximum potential use exists.

Table 1 shows the results of this survey as to methods of transporting and end use. Although no new applications were revealed by this survey, it does show that some of the earlier research

work has been developed into limited commercial markets for flyash. No reporting company, however, had found sufficient markets for 100% disposal.

Two companies are each selling approximately 20,000 ton per year mostly for bricks, blocks and building construction. Through continuing research and aggressive selling they are certain that sales will be substantially increased in such markets. Another company has had good success in disposing of most of their flyash for asphalt road paving during the warmer months. Bagging, as reported by one company, is being done to stimulate interest in the product and eliminate special handling equipment and dust nuisance on the part of the user. Although bagging, Fig 5, is not the most efficient means of disposal, some users appear willing to pay for it in such a convenient form.

As a result of this recent survey coupled with the counsel of many engineers in the power field, the present status of disposal may be summarized as follows:

1. Although the major portion is still disposed of as fill or allowed to accumulate on vacant land, an increasing amount is being used in commercial products.

2. Principal commercial use is in building construction, blocks, bricks, and asphalt road construction.

3. Acceptance has been slow because the price users are willing to pay seldom makes the business even self-supporting for the sellers.

4. Some industries with relatively small amounts are using it as filler in their own products.

5. There is an increasing recognition of the necessity of knowing the physical and chemical properties before judging its value as a component of a commercial product.

6. It is the author's opinion that at least $75,000 per year is now being spent on flyash research and activities to stimulate its use.

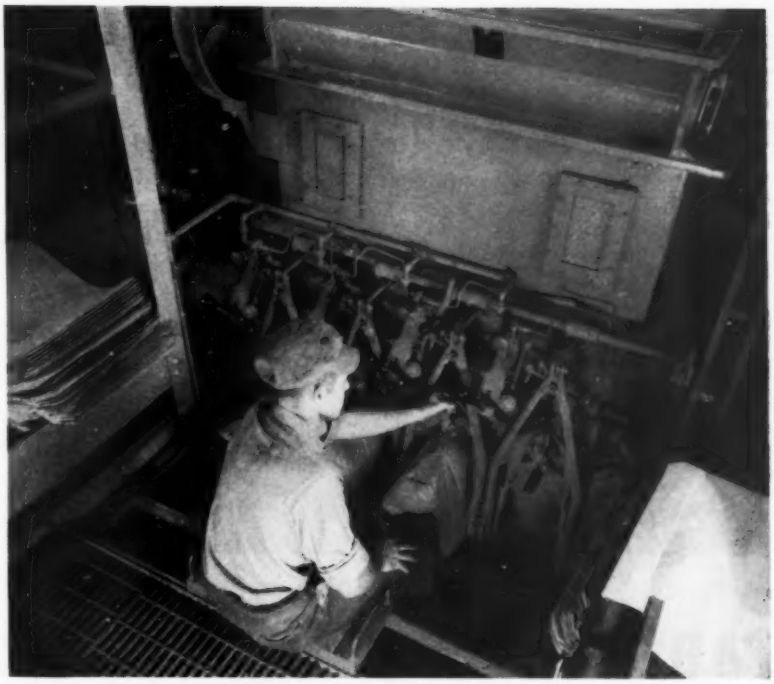

Fig. 5—Flyash can be bagged in a machine such as this, when users so specify. Transportation is simplified, even though the capital equipment costs are higher

Assistance and counsel of many utility and industrial plant engineers are gratefully acknowledged. In addition the author is indebted to R. B. Engdahl, Supervisor, Fuels Division, and C. W. Porterfield, Research Engineer, Battelle Memorial Institute, Columbus, Ohio, for their assistance in the search of and review of bibliography on flyash research.

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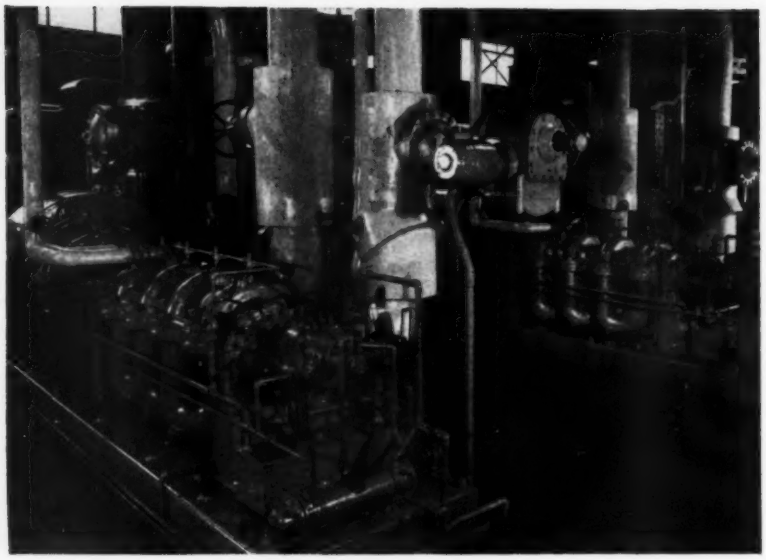


A simple control circuit used with duplicate pumps provides insurance against plant shutdowns because of pump, motor, coupling or starter failure in electrically-driven pumps that supply circulating water, feedwater or for condensate return

Fig. 1—When extra pumps are needed for stand-by service, an automatic transfer is a small, but necessary, investment

AUTOMATIC TRANSFER OF WATER PUMPS

FRANK E. REEVES, *Design Engineer, Barnard and Burk*

DUPLICATE PUMPS and controls are frequently provided for boiler feedwater, turbine condensate return, cooling water and other requirements vital to the operation of the plant. A control, which immediately and automatically transfers the load to the spare pump when the one in use fails, is a small investment compared to the cost of water supply interruptions.

This recently developed control circuit, used in an Alaskan power plant, is simple and flexible in operation. The following features are included: (1) selection of either pump as the leading pump, (2) automatic starting of, and load transfer to, the follow-up unit if pressure is low in starting, or at any time thereafter, (3) automatic shutdown of the leading pump after failure, (4) sounding of an alarm when leading pump fails, (5) fool-proof method of silencing alarm, (6) provision for silencing alarm if follow-up machine also fails, (7) provision for normal routine transfer of load without interruption of supply and (8) protection against starting pump with the gate valve closed.

The diagrams shown were used on two motor-driven circulating-water pumps. Motors are 125 hp, 2300 v, 60 c. Each drives centrifugal deep well pumps which feed into a common 12 in. line to the power plant system.

A section of a control panel in the pumping station contains a *Hand-Off-Automatic* selector switch for each unit. The pressure switches are connected in the pump discharge lines between pump and check valve, as shown in Fig. 2, and a limit switch on each gate valve closes its contact only when the valve is in its fully open position. All other equipment is on the turbine gage board.

Sequence of Operation

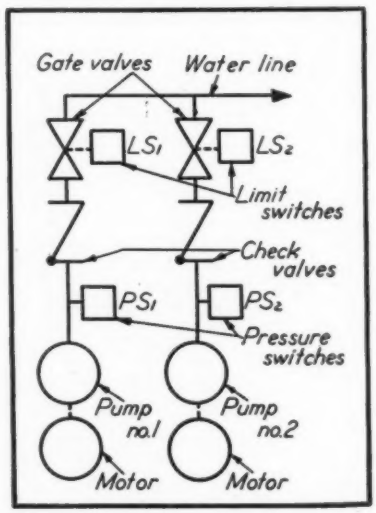
Assume that pump 1 is picked as the leading pump. Set the selector switch, Fig. 4, to position 1, which will close contacts S_{1A}, upper left, Fig. 3, S_{1B}, left center, and S_{01} and S_{02}, in center alarm circuit.

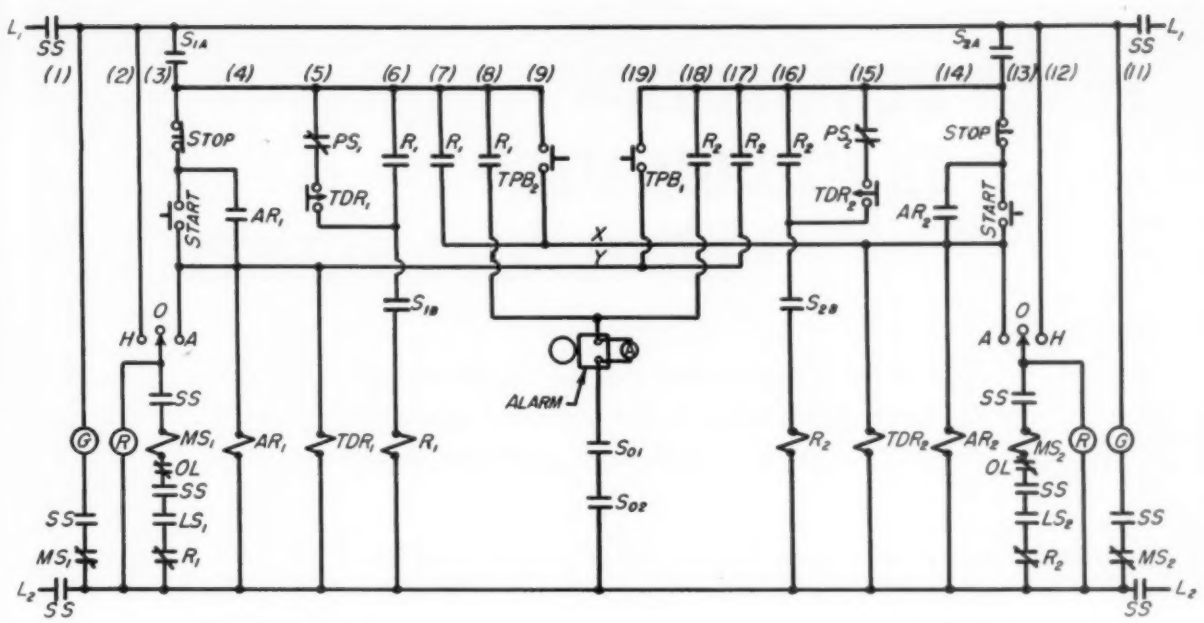
Individual circuits in Fig. 3 are numbered to correspond to the following sequence: (1) The safety switch contacts, SS will be closed. (2) The *Hand-Off-Automatic* switch will be set on A, which energizes the *Start-Stop* circuit directly above. (3) Pressing the start button energizes MS_1, which starts the pump motor provided contacts LS_1, below, are closed, insuring that the gate valves *are open.*

(4) The start button also energizes relay AR_1 closing its holding contact across the start button and (5) the time delay relay, TDR_1. At the end of the delay period, TDR_1 contact, above, closes, and if the pressure switch contact PS_1 has not opened because the pump failed to build up pressure during the delay period, then (6) relay R_1 is thereby energized, closing its holding contact directly above. (7) The next of the R_1 contacts makes connection X alive, and starts pump 2 by energizing MS_2 in circuit 13 at the right.

(8) The third R_1 contact closes the alarm and amber pilot light circuit. At

Fig. 2—Schematic of water connections also shows pressure and limit switches





MS_1, MS_2 ....Motor starters for pumps
TDR_1, TDR_2 .....Time delay relays
TPB_1, TPB_2 .....Transfer push buttons
H, O, A, ...Hand-Off-Automatic switch
S_{01}, etc .....Selector switch (Fig. 4)
LS_1, LS_2 .....Limit switches (Fig. 3)
PS_1, PS_2 .....Pressure switches (Fig. 3)
R, G, A .....Pilot lights (in circles)
R_1, R_2 .....4-pole relays (3 n.o., 1 n.c.)
AR_1, AR_2 .....1-pole relays (n.o.)
OL .....MS overload contacts
SS ....Safety switch (isolates control)

Fig. 3—The dual control circuit provides automatic transfer. Circuits 1 to 4 are for normal start and run. Circuit 5 allows delay to reach pressure on starting, 6 to 8 transfer load and sound alarm on low pressure. Circuit 9 is for manual transfer

the same time, the normally closed contact of R_1 in circuit 3 opens the circuit of MS_1 to trip out pump 1. Relay AR_2 in circuit 14 was also energized by R_1 but it will not seal in the coil of MS_2 while contact S_{2A} is open. To silence the bell and de-energize the amber light, the selector switch must be transferred to position 2. "Make-before-break" contacts, Fig. 4, prevent momentary interruptions of the power to pump 2 during the switching operation. With the switch in position 2, contact S_{2A} seals in the coil of MS_2 through AR_2. Contact S_{1A} opens and relays R_1 and AR_1 drop out, de-energizing the bell alarm and amber light.

After failure of pump 1, that unit may be taken out of service for repairs or inspection and the *Hand-Off-Automatic* switch for pump 1 must be thrown to the "off" position. Otherwise, if pump 2 fails, pump 1 will be restarted automatically (or control is energized).

Since the circuit is symmetrical, the sequence of operation, starting with circuit 11, will be similar if pump 2 were selected as the leading pump.

If one pump fails to build up or maintain pressure and the second pump starts automatically and fails to build up, the bell may be silenced by turning the 4-position selector switch to either of the "off" positions.

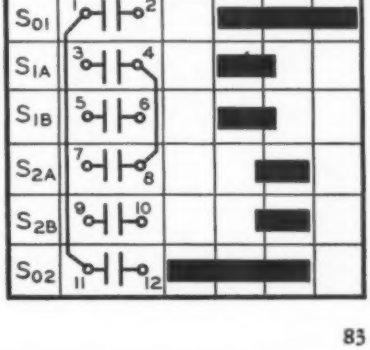
(9) Under normal operation, in order to transfer the load from one pump to the other, transfer push buttons are used. If pump 1 is leading, TPB_2 is pressed and held long enough for the selector switch to be transferred to position 2. To transfer from pump 2 to pump 1, TPB_1 is used in a similar manner as above.

If the *Hand-Off-Automatic* selector switch at the pumping station for the leading unit is in the "Off" position and an attempt is made to start it, the bell alarm will sound after the time delay period has expired and automatic transfer to the follow up unit will occur. This feature also helps determine the reason for failure to build up pressure. The red pilot would not light if the starter coil were not energized, but it would light in the event of coupling or impeller failure.

This control scheme was used in the Alaskan power plant on circulating water-pumps located in a pumping station at a borrow pit several hundred feet from the power plant. The convenience of having the pumps automatically transfer in case of failure is, in itself, worth the effort of providing such a control. In this case, however, as in many other instances, an interruption in the water supply would have caused considerable damage, and the feature of immediate transfer to the stand-by pump is invaluable.

Condensate and boiler feed pumps may be controlled by similar schemes. Other types of electrically-powered supply circuits could use the same system if the pressure relay were replaced by one sensitive to the liquid level, rate of flow or other factor important to the operation. For example, the output of d-c motor-generator sets could be maintained by the use of either voltage or current-sensitive relays in place of the pressure switch used for water.

Fig. 4—Development of selector switch. The overlapping contacts avoid service interruptions during routine transfers



POWER DISTRIBUTION IN MEDIUM SIZED INDUSTRIAL PLANTS

Final part of this article gives methods and advantages for handling lighting loads, regulation, power factor and grounding by the load center system, with suggestions for modernization and expansion

H. B. LLOYD, *Industrial Power Division, General Electric Company*

THERE ARE TWO ways in which lighting loads may be handled on the load center distribution systems described in the first part of the article appearing in the July issue. First, separate load center units for the entire plant lighting, and second, from unit substations supplying power to particular areas. A review of the factors involving the two methods will show that the unit substation scheme, Fig. 1, is more economical. This is reasonable because a system utilizing separate substations for light and power requires, in reality, a dual distribution system throughout the plant. Where 480 v is used for power, the lighting load from the unit substation may be obtained in one of two ways—small dry type transformers can change the 480 v to the lighting voltage, or a wye-connected, 480-v system can furnish 277 v (line to neutral) for fluorescent lighting.

Greater system reliability can be attained by grouping the lighting and power loads together. Overlapping the lighting areas provides for shutting down a unit, and is more satisfactory than emergency lighting that relies on one source for the entire lighting load.

Voltage Regulation

Voltage variation at the utilization point, as loads vary from no load to full load, must be kept within certain limits, depending upon the type of equipment involved. Some equipment, particularly the electronic type, is more susceptible to voltage variations than others. Electric furnace output is decreased in proportion to the square of the voltage, and motors develop less torque at reduced potentials. The life of the insulation is shortened on overvoltage. Generally speaking, variations should be limited to plus or minus 3 percent, but should not exceed plus or minus 5 percent.

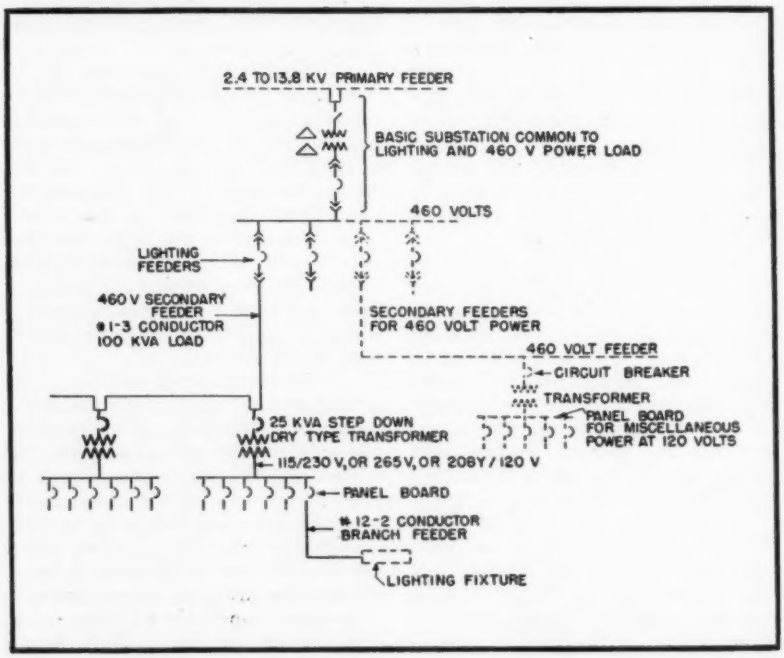
Voltage regulation can be charged to all parts of the system—power company equipment, primary feeders, step-down transformer and secondary feeders. If total expected variation is too great, improvement may be effected by: (1) higher voltage operation on both primary and secondary systems, (2) carrying the primary voltage closer to utilization loads, Fig. 2, (3) installing larger cables, more circuits, (4) using multiconductor cable, instead of open wiring, for lower cable reactance, (5) tap changing under load, and (6) voltage control for all or parts of the plant.

System Arrangements

Two distribution systems applicable to most industrial layouts are the radial and the secondary selective arrangements of substation feeders.

Most common and least expensive is the radial system. A typical example, Fig. 3, consists of a single primary

Fig. 1—Load center units for light and power eliminate separate lighting system. Overlapped areas provide light when power fails in a load center


2.4 TO 13.8 KV PRIMARY FEEDER
BASIC SUBSTATION COMMON TO LIGHTING AND 460 V POWER LOAD
460 VOLTS
LIGHTING FEEDERS
460 V SECONDARY FEEDER
#1-3 CONDUCTOR
100 KVA LOAD
SECONDARY FEEDERS FOR 460 VOLT POWER
460 VOLT FEEDER
CIRCUIT BREAKER
TRANSFORMER
PANEL BOARD FOR MISCELLANEOUS POWER AT 120 VOLTS
25 KVA STEP DOWN DRY TYPE TRANSFORMER
115/230 V, OR 265 V, OR 208Y/120 V
PANEL BOARD
#12-2 CONDUCTOR BRANCH FEEDER
LIGHTING FIXTURE

feeder and a single transformation to low voltage for a particular load area, making it the most simple installation. As a source of emergency power is not provided in event of an outage of the basic unit, it is most suitable for general service where a power failure is not especially detrimental.

Secondary selective systems, Fig. 4, consist of two radial units inter-connected through normally open tie breakers, B, on the secondary side. This system is especially suitable for continuous process industries where service continuity is important. Operating simplicity of the radial system is maintained, yet a high degree of service reliability and economy is provided. Under normal operations, both transformers share the load, resulting in better voltage regulation.

Representative relative costs of these distribution arrangements for 480-v service, as installed in medium sized plants, are as follows: radial—100 percent (base comparison) and secondary selective—105 to 140 percent depending upon the reserve capacity provided in each transformer.

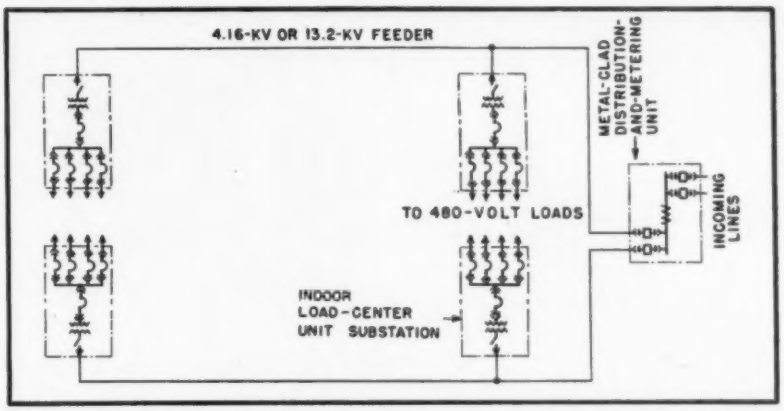


Fig. 3—Radial type of load center distribution system is the most simple and inexpensive. It is suitable if power interruption is not detrimental

Grounding

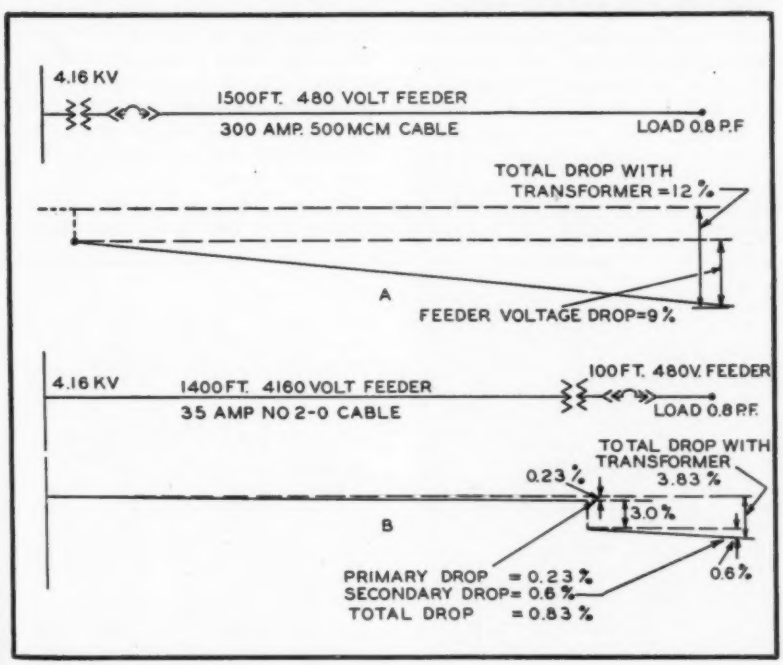
Grounding the neutrals of a power system offers advantages in all plants and at all voltage levels. However, from a practical sense, it is not always possible to adhere to this generalization because of the differences in cost between standard apparatus applied to new systems and the reconstruction of an existing system.

Usual practice is to solidly ground systems of 600 v and below, and depending upon the size of the system, to ground solidly or through a resistor above this range up to 15 kv. Most emphasis is placed on grounding 480-v, 4160-v, and 13.8-kv installations, because these have the preferred voltage levels, and standard components have been set up to favor system grounding. The benefits can be obtained at these voltage levels at minimum expense.

Advantages of grounding exist, none-the-less, for other voltage classes. Extra equipment, however, is generally required to obtain access to the system neutral for ground connections.

Some advantages obtained from grounded system operation are:

Fig. 2—Low voltage distribution, A, results in high voltage drops. Load center system, B, provides good regulation, saves copper in most layouts



(1) High, transient over-voltages, several times normal value, may appear in ungrounded systems during switching of circuits having a line to ground fault. These transients cannot occur in a grounded circuit. Life of electrical insulations consequently will be increased and service interruption and repair bills minimized.

(2) Ground-faulted feeders are automatically and selectively disconnected from the system because relays that respond to ground-fault currents are coordinated with the amount of such current permitted to flow. This feature of grounded operation reduces the time the system must be out of operation while the fault is being located. This procedure also eliminates the probability of incurring a second fault (which might have been caused by the ungrounded transient over-voltages described previously) thereby taking two important circuits out of service.

(3) Lightning arresters designed for grounded-neutral systems afford better protection for equipment than those designed for ungrounded-neutral systems frequently used in the past.

Where resistance grounding is employed, the ground fault current is limited as much as possible while still permitting accurate relaying. Thus, burning at the point of fault and mechanical stresses in circuits and apparatus are reduced, and consequent damage to the machines and circuits is minimized. Similarly, the hazard to personnel and structures brought about from stray ground fault currents, and the voltages, which can appear in the ground current path, are reduced.

Power Factor

A-c current required by utilization devices such as induction motors and transformers may be considered to be made up of two parts—power producing and magnetizing—which combine vectorially, Fig. 5, to become the actual

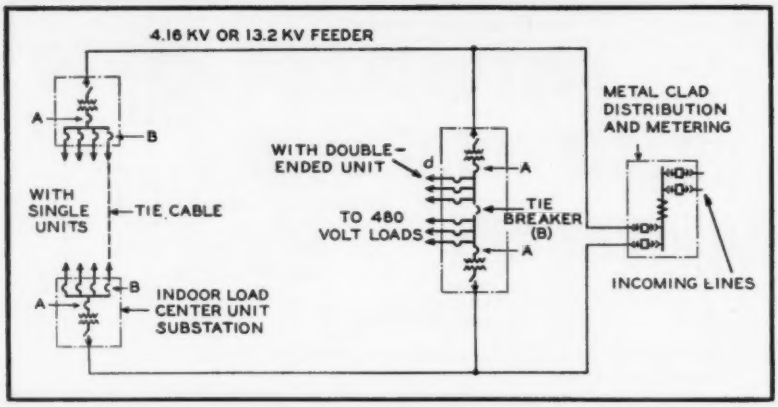


Fig. 4—Secondary selective system is two radial units with normally-open tie breakers, B. One unit carries both loads during power outage on other

current at the terminals. The power producing, or kw, current does useful work in the drive. Magnetizing, or kvar, current produces the flux necessary in the operation of induction devices, and reaches its peak values 90 electrical degrees, or one-quarter cycle of time, *after* the power current reaches its peaks, and therefore does not add directly to it.

The circuit power values are found by multiplying the corresponding currents by the line voltage and dividing by 1,000. Units are kilowatts for the power producing portion, kilovars for the magnetizing component and kilovolt-amperes (kva) for the combined or total value. Power factor is the ratio of the working to the total, or apparent power, and a high value means that most of the current carried by the circuit is doing useful work. Low power factors should be raised to reduce power charges, increase system capacity and decrease voltage drops.

Improvement methods are particularly important where a power factor clause, or its equivalent, is part of the rate structure. These methods consist of drawing a leading current (power units are also kilovars), which is 90 electrical degrees *ahead* of the power component and therefore neutralizes the magnetizing current. A synchronous motor can be caused to draw leading current from the supply lines by field over-excitation, or capacitors may be installed, and thus reduce the kva required from the power supply, Fig. 6. There is also a savings in cable.

Seldom is it economical to improve power factor to 100 percent because a point of diminishing returns will be reached. In general, however, a high value in the order of 90 to 95 percent can be justified. The amount of improvement necessary will depend upon the original power factor and the local conditions involved, such as type of rate clause and degree of overloading.

Modernization and Expansion

Any practical modernization or expansion program must take into consideration the equipment that exists, good or bad, and plans must be made in keeping with sound engineering principles and economic facts. A new system should be laid out that will be conducive to later expansion. The first approach is to lay out the best system, with no regard to existing conditions. Then the existing installation should be checked to see how the new one could fit into the layout.

Modernization or expansion, which patches up an existing system to make it acceptable for the present or to supply some additional new load, is generally false economy if it does not prepare for other expansions to follow. Any expenditure should be based on an ultimate plan for improved, modern and safe distribution.

Greatest savings can usually be made by modernizing or expanding with a load center system and a higher distribution voltage. Benefits of each have been discussed previously and they are as applicable and effective in modernization or expansion as in new plant construction and installation.

Fundamentals

Certain fundamentals apply, whether new plant construction, modernization, or expansion is being considered. The matter of short circuit currents is important and any system, new or old, should make adequate provision for them. High voltage levels and applied load center principles will help keep short circuit currents down, as well as offer other economic advantages.

Most popular plant distribution voltages are 4.16 and 13.2 kv, and most common utilization voltage is 480 v. These have become preferred levels for good economic reasons, and standard components, that lend themselves to system groundings, are available.

Power distribution systems are a very important link in any industrial plant. These should be given early and full consideration when planning new plants, or when modernizing or expanding old plants so that construction is not impeded by electrical details.

Fig. 5—Magnetizing (kvar) part does no work, increases total line current

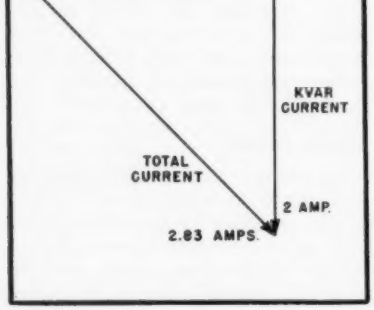
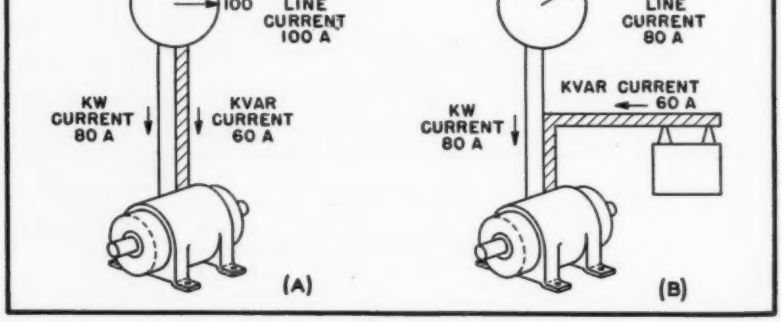
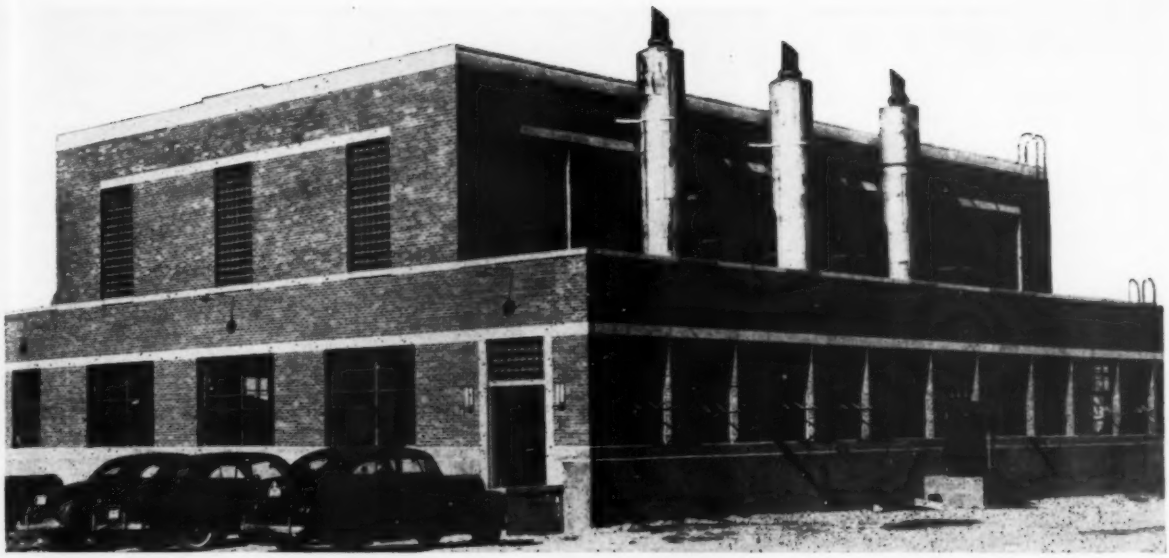


Fig. 6—Induction motors (A) have high magnetizing components. The leading currents of capacitors (B) oppose magnetizing part and lower line current





Attractive brick building houses three new diesel engines. Exhaust snubbers and intake air filters are mounted on bay roof

DIESELS SERVING "LIFE SENTENCE" AT MISSOURI STATE PENITENTIARY . . . . .

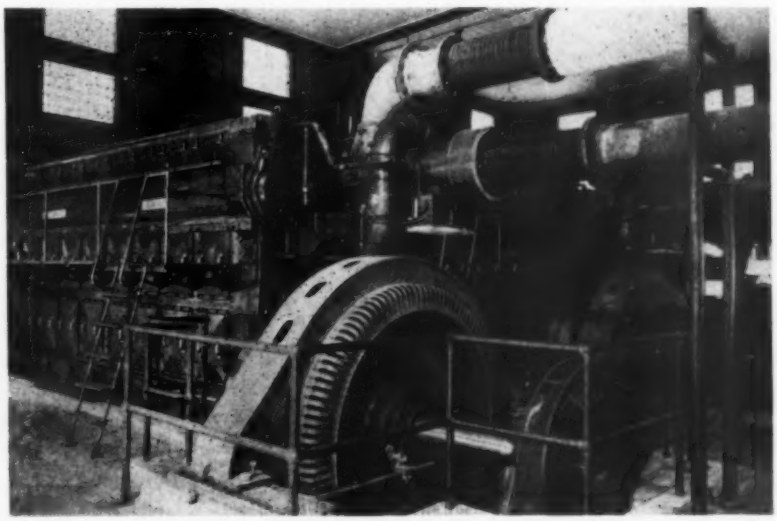
. . . . Have saved $10,000 on fuel bill in 4 months of operation

THREE 1,440 hp dual-fuel engines, constituting the largest prison diesel plant in the nation, are operating efficiently, for the Missouri State Penitentiary at Jefferson City. The units placed into service in May, 1949, have saved the state $10,000 in the first four months of operation. Projects now under way will increase the rate of saving substantially and possibly pay off the plant in less than two years.

This second largest penitentiary in the United States has factories producing shoes, binder twine, commercial cordage, furniture, and many textile products. In addition they manufacture all the license plates and highway markers used in the state. With laundries, kitchens, service industries, and a heavy lighting load, the peak loads add up to 1,350 kw with valley loads never less than 700 kw.

Since 1938, power requirements had been met with two 1,500-kw steam turbines. In theory this should have been an economical arrangement since large quantities of steam were needed for heating purposes. Yet, the dual-purpose plant proved expensive and became progressively more costly as the boilers deteriorated. An engineering study determined that diesels would save the state money even without utilization of waste heat. For this reason a modern power plant was built just outside the prison walls.

An attractive brick building, trimmed with stone and glass brick, houses three



Turbine driven supercharger in foreground has increased diesel efficiency so costs average 7.33 mills per kw-hr

TABLE I.—FOUR MONTHS OF DIESEL OPERATION

1949	Kw-hr generated	Fuel gal	Kw-hr per gal
June	374,400	29,713	12.60
July	491,200	35,914	13.67
Aug.	414,400	30,248	13.70
Sept.	420,800	31,111	13.52
Totals	1,700,800	126,986	13.39

identical 8-cylinder, 14½ x 20 in., supercharged, dual-fuel diesels that develop 1,440 hp at 360 rpm. Each unit drives directly a 1,000-kw synchronous generator with V-belted 15-kw exciter. Accessory equipment is in keeping with the quality of the heavy-duty engines.

Plant Efficiency

Jefferson City at the present time does not have enough natural gas to operate the diesels. But, pipe-line expansion is underway and the engines were connected to the gas line, and ultimately they will be able to switch from oil to gas at a moment's notice.

Even with relatively expensive fuel oil, the new plant quickly proved its efficiency. In June, the first full month of operation, the saving on fuel alone amounted to $2,639.65. In the first four months, the saving totaled $9,598.48. Actually, this saving is figured conservatively. Since the old steam plant provided heat as well as power and as they still supply heat, prison engineers calculate the saving by comparing total cost of fuel for power and heat provided by the steam plant with the combined cost of diesel power and steam heat under the current arrangement. Thus, the inefficient boilers still are eating into the power savings. New oil fired boilers, designed specifically for the heating job are being installed and the cost picture will be brighter.

Natural gas, it is hoped, will double the savings on power. The present fuel cost per kw-hr is 7.33 mills and with gas at 28 cents per MCF, the cost of a kw-hr is estimated at 2.86 mills.

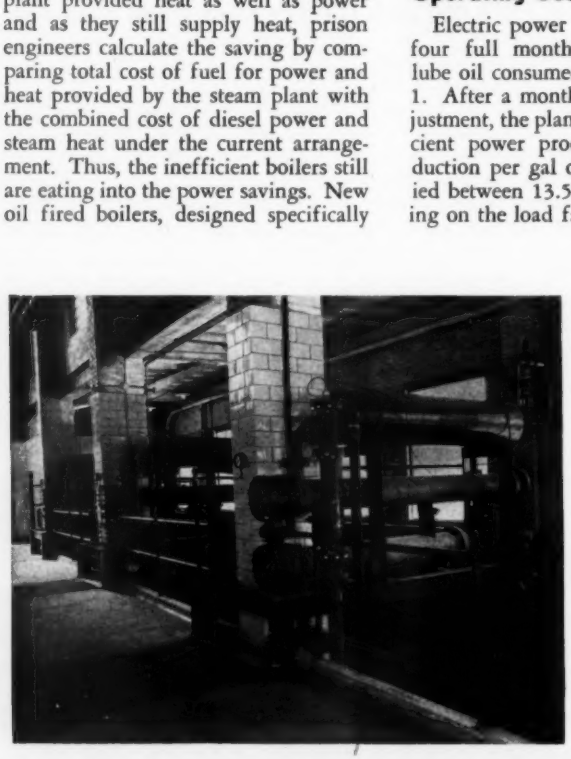
A. L. Johnson is set to press the dual-fuel button and change-over to natural gas

Operating Cost

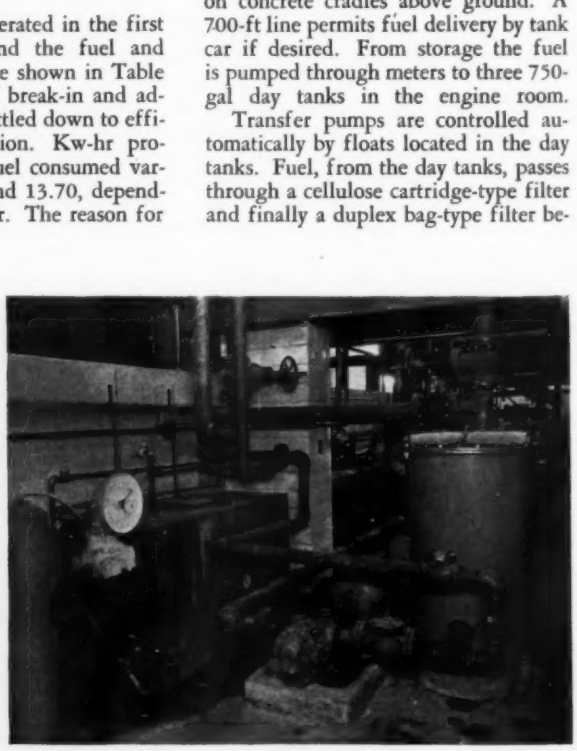
Electric power generated in the first four full months and the fuel and lube oil consumed are shown in Table 1. After a month of break-in and adjustment, the plant settled down to efficient power production. Kw-hr production per gal of fuel consumed varied between 13.52 and 13.70, depending on the load factor. The reason for these excellent results is careful operation of prime movers that are adequately protected with auxiliary equipment. Fuel, lube oil, and air are filtered; and the water is softened.

Fuel, No. 3 oil, is trucked to the plant and unloaded into three 21,300-gal horizontal steel cylinders resting on concrete cradles above ground. A 700-ft line permits fuel delivery by tank car if desired. From storage the fuel is pumped through meters to three 750-gal day tanks in the engine room.

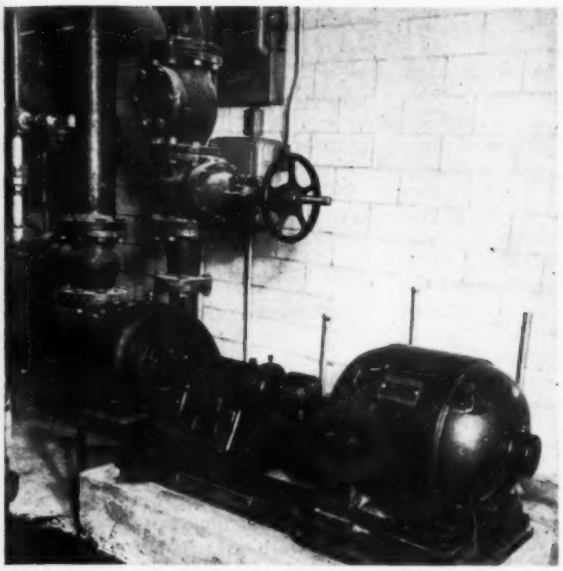
Transfer pumps are controlled automatically by floats located in the day tanks. Fuel, from the day tanks, passes through a cellulose cartridge-type filter and finally a duplex bag-type filter be-



Gas surge tank (top), heat exchanger (center) and oil cooler operate as a unit in conjunction with companion diesel



Three separate units comprising day storage tank, fuel oil and lube oil equipment are tied into an individual diesel



One of six pumps employed for jacket cooling and raw water

Induced-draft cooling tower can handle load of four diesels

fore it enters the engines. Day tanks are equipped with a high and low-level alarm designed by the prison's own engineers. Automatic shut-off valves cut off fuel flow if the line breaks.

Engines are lubricated by a detergent oil, which is circulated by built-in pumps from external sump tanks. Motor-driven rotary pumps also are provided to bring up oil pressure before starting the engines and to maintain pressure when shutting down. Lube oil is drawn continuously from each sump tank by a small motor-driven pump and put through a cellulose cartridge filter. There is also a small filter and a shell-and-tube oil cooler for each diesel.

Each engine has a separate closed cooling system that contains a motor-driven centrifugal pump and shell-and-tube heat exchanger. Prison water with 18 gr. of hardness as calcium carbonate is treated in a softener before entering the system. Another set of three centrifugals sends treated raw water from the exchangers to a dual, induced draft cooling tower, which is large enough to handle four engines when required.

Engine air is drawn through oil impingement-type filters that are located on the roof of a bay. The same roof also contains the vertical exhaust snubbers. Diesel exhaust gases turn turbines, which force air to the power cylinders under pressure with resultant increase in engine capacity.

Starting air is provided by two small compressors, one motor-driven, the other powered by a gasoline engine. The motor-driven unit is controlled by an automatic switch that keeps 210 to 250 psi pressure in three air tanks.

Control panels near each engine are compact; and each includes an exhaust pyrometer, pressure gages, auxiliary control switches, and an alarm system with horn and signal lights. Modern dead-front switchboards, set flush with the wall, are particularly well equipped. Each engine panel has an a-c and d-c ammeter, a power factor meter and synchronizer switch. A synchronizer panel includes a 120-v voltmeter, which seems to permit a closer check on voltage than the usual high-voltage meters. Rocking-contact regulators have enabled the plant to keep within one volt of the desired voltage. Conveniently grouped controls at the engine and on the switchboard make possible one-man operation. An engine can be started and placed on the line under heavy load in just 59 seconds.

Electricity at 2,400-v, 3-phase, 60-cycle is distributed through underground cable to five prison substations where it is stepped down to 480-v, 3-phase for power utilization and 120/-240-v single-phase for lighting.

All piping will be color-coded with white for raw water, gray for jacket water, brown for fuel oil, orange for lube oil, yellow for starting air, and red for gas. The walls above the tile will be cascade green, the engines, generators and accessory equipment a medium green, the floors gray.

PRINCIPAL EQUIPMENT IN THE MISSOURI STATE PENITENTIARY

Diesel engines	National Supply Co., Superior Engine Div.
Generators	Electric Machinery Mfg. Co.
Turbo-chargers	Elliott-Buchi Co.
Fuel transfer pumps	Geo. D. Roper Corp.
Fuel meters	Pittsburgh Equitable Meter Div.
Fuel filters	The Hilliard Corp.
Fuel filters	Purolator Products, Inc.
Lube oil	Cities Service Oil Co.
	Standard Oil Co. (Indiana)
Lube oil pumps	Geo. D. Roper Corp.
Lube oil filters	The Hilliard Corp.
Lube oil filters	Purolator Products, Inc.
Cooling tower	Water Cooling Equipment Co.
Water softener	General Filter Co.
Heat exchangers	Graham Manufacturing Co.
Cooling water pumps	Ingersoll-Rand Co.
Air compressors	Quincy Compressor Co.
Air filters	Air-Maze Corp.
Exhaust snubbers	Burgess-Manning Co.
Silencer on turbo-chargers	Air-Maze Corp.
Pyrometers	Illinois Testing Laboratories, Inc.
Voltage regulators	Allis-Chalmers Mfg. Co.
Meters	Westinghouse Electric Corp.
Circuit breakers	Roller-Smith
Watt-Hour meters	Duncan Electric Mfg. Co.
Rectifiers	Westinghouse Electric Corp.
Underground cable	Simplex Wire & Cable Co.
Switchboard	Wm. Wurdack Electric Div.

CHEMICAL REMOVAL OF COPPER FROM BOILERS

R. G. CALL and W. L. WEBB,
American Gas and Electric Service Corporation

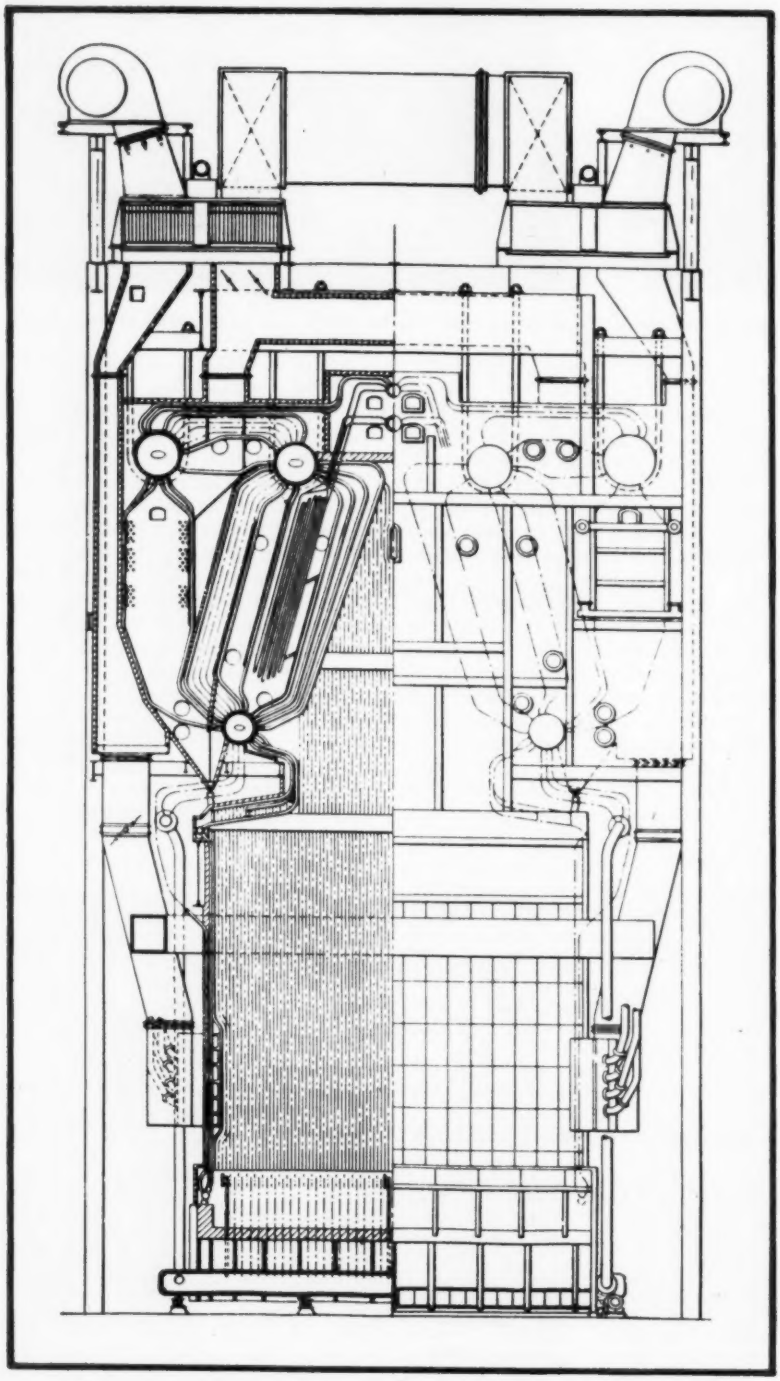


Fig. 1—Six-drum boiler is rated at 1350 psi, 925 F and 1,000,000 pph

After acid cleaning one of the Logan Plant* boilers the metal surfaces were found heavily plated with copper, which later came loose and obstructed circulation. Using laboratory tests, the engineers found a solvent that removed 300 lb of copper

IMMEDIATELY after the third acid cleaning of boiler "A" in March, 1949 with 5% inhibited hydrochloric acid followed by a conditioning boil employing a 0.25% sodium chromate solution, selected wall tubes were turbined, removed deposits weighed and three samples analyzed. Results are in Table 1.

These indicated an average copper content of about 52% and an average deposit weight of 125 grams for a pair of tubes forming a bifurcated tube 37 ft long. In general, the after-deposits appeared to be more extensive than in any previous case, partly because all surfaces were plated with copper, much of which had become detached.

Thickness Varied

The plated copper not only was heavier in the lower part of the boiler, but the maximum thickness (about 12 mils) occurred on highly stressed metal such as rolled ends of tubes and tube flares.

Twelve hours after the boiler was returned to service, a floor screen tube failed in the form of a 6-in. longitudinal split on the bottom of the tube about 5 ft from the lower waterwall header. This failure was believed to have resulted from repeated cold working of the tube in straightening bends caused by heavy pieces of falling slag. During this outage, drums and lower headers were found to contain much dislodged sheet copper. About 75 to 150 lb were removed.

During an outage in Oct.-Nov. 1949, representative tubes were turbined and deposits collected and analyzed as before. These data are indicated in the right-hand portion of Table 1.

Subsequent tests of the initially recommended copper solvent by both the American Gas and Electric Service Corporation's General Laboratory and the chemical cleaning service organization indicated that the efficiency of the solvent left much to be desired.

*Abstract of paper delivered at the ASME semi-annual meeting, St. Louis, June 19-23, 1950.

Drawing upon its experiences with oxidizing agents in ammonium hydroxide for the etching of copper prior to metallographic examination, the laboratory concentrated its efforts on solvents of this type. The oxidizing materials investigated included perborates, peroxides, and persulfates.

The data obtained indicated that ammonium persulfate in the presence of sufficient ammonium hydroxide offered promising possibilities as a solvent for copper. The data obtained with a number of persulfate solutions indicated the following:

1. A solvent of this type acts extremely rapid at room temperature in removing copper from iron surfaces.

2. The reactions involved are of a complex nature and are not stoichiometric with respect to persulfate concentration.

3. It may be that the dissolution of copper by solvents of this type is due not only to the oxidizing reagent and ammonia, but also to atmospheric oxygen and cell action currents.

4. The addition of a small amount of sodium hydroxide to the solutions tested appeared to increase the initial attack of the copper.

5. The persulfate type of solvent is considerably more expensive than the basic chlorate type.

Economic consideration of the various formulas investigated indicated that the use of one containing 0.75% ammonium persulfate, 1.4% NH_3 and 40 ppm of sodium hydroxide might be justified on the basis of certainty of removal of copper from boiler "A".

Small sections of a boiler tube removed from boiler "A" with deposits intact were treated with the solvent. Examination of the remaining deposit showed the absence of copper. The specimens were then acid cleaned and after removal of the iron oxide, copper was found plated on the tube.

In order to study the effect of the copper solvent upon corrosion of un-

TABLE 1—WEIGHTS AND ANALYSES OF BOILER "A" WALL TUBE DEPOSITS FOLLOWING THE MARCH 1949 CLEANING AND PRECEDING THE JANUARY 1950 CLEANING

Bifurcated tube Designation		Following March 1949 Cleaning				Before January 1950 Cleaning					
		Weight (grams)	Analysis (%) Ign. loss	*Fe_2O_3	Cu	Weight (grams)	Analysis (%) Ign. loss	*Fe_2O_3	Cu	Zn	SiO_2
North wall, East	18	76	—	—	—	—	—	—	—	—	—
	20	—	—	—	—	238	—	—	—	—	—
West	15	67	—	—	—	—	—	—	—	—	—
	16	80	—	—	—	—	—	—	—	—	—
	30	—	—	—	—	340	5.5	57.6	27.8	6.4	0.8
	32	214	7.5	33.1	57.8	10	7.1	52.3	37.8	—	—
South wall, East	5	48	—	—	—	—	—	—	—	—	—
	13	—	—	—	—	280	5.8	47.6	39.3	—	—
	25	136	—	—	—	—	—	—	—	—	—
West	3	—	—	—	—	170	—	—	—	—	—
	33	115	—	—	—	—	—	—	—	—	—
	35	99	—	—	—	10	—	—	—	—	—
East wall, North	3	—	—	—	—	220	—	—	—	—	—
	8	124	11.1	38.3	51.4	33	8.0	39.6	48.4	—	—
	9	164	—	—	—	—	—	—	—	—	—
	16	158	—	—	—	—	—	—	—	—	—
South	3	—	—	—	—	238	—	—	—	—	—
	14	129	—	—	—	—	—	—	—	—	—
	20	—	—	—	—	200	22.3	73.6	3.5	—	0.9
West wall, North	7	102	—	—	—	—	—	—	—	—	—
	18	224	10.7	42.0	47.7	7	9.4	46.1	45.3	—	—
	22	196	—	—	—	—	—	—	—	—	—
South	2	65	—	—	—	—	—	—	—	—	—
	15	—	—	—	—	224	—	—	—	—	—
	18	—	—	—	—	285	6.8	52.2	34.0	—	—
AVERAGE		125		Average excluding tubes turbined following March 1949 cleaning		246					

* Present predominantly as magnetic oxide.

TABLE 2—ANALYSES OF ACID AND COPPER SOLVENTS AS DRAINED FROM BOILER "A" FOLLOWING THE JANUARY, 1950 CLEANING

Acid Solvent		*Copper Solvent*	
Hydrochloric Acid (HCl)	6.09%	Ammonium Persulfate ($(NH_4)_2S_2O_8$)	0.013%
Copper (Cu)	Trace	Ammonia (NH_3)	0.970%
Iron Oxide (Fe_2O_3)	1.0%	Copper (Cu)	0.113%
Phosphate (PO_4)	0.04%	Iron Oxide (Fe_2O_3)	0.011%
Calcium (Ca)	0.0014%		
Magnesium (Mg)	0.0014%		

TABLE 3—COST ITEMIZATION FOR BOILER "A" CLEANING OF JANUARY 1950

Acid Solvent Stage		*Copper Solvent Stage*	
Inhibited Hydrochloric Acid	$3417	Ammonium persulfate	$ 598
Cleaning organization's service and mileage charges	1478*	Ammonium hydroxide	990
Unsalvable temporary piping	230	Cleaning organization's service and mileage charges	1382*
Nitrogen	383	Local Labor and supervision	325
Local labor and supervision	1455		
Total	$6963	Total	$3295

Acid solvent stage, total	$ 6963
Copper solvent stage, total	3295
Grand Total	$10258

* Allocated from total charge on the basis of proportionate time required.

plated surfaces, and to detect possible replating of copper from the copper solvent, tests were made in which only one-half of the boiler tube section was plated. In a typical test where the weight of copper initially plated on the tube was 9.6 grams, the unagitated solvent maintained at 98-101 F in the tube for six hours contained 1.65 grams of copper.

This solvent was drained and a fresh charge added. At the end of two hours the fresh solvent had taken 2.87 grams of copper into solution. Another fresh charge of solvent at the end of two hours contained 2.73 grams of copper. From these data it was evident that replating of the copper had occurred and examination of the tube showed that the replating was confined to a narrow band at the bottom.

The copper solvent is strongly alkaline at all times, and it is believed the redeposition of copper is due to the higher density copper - ammonium complex settling to the bottom of the tube. This sets up a cell action between two metals and two solutions of different composition.

Replating Reduced

In another test where the copper solvent was occasionally agitated, replating was considerably reduced as shown by the presence of 3.4 grams of copper in the solution at the end of six hours.

Recognizing that the conditions under which replating occurred, might not exist if the tests were conducted more on the order of the conditions encountered when cleaning the boiler, the bottom inlet to the boiler tube section was equipped with an orifice so that filling would require 2 to 3 hr, a period comparable to that required for filling the boiler.

In another group of tests the tube section was first plated over its entire length with 3.34 grams per ft or a total of 8.6 grams of copper. The copper solvent was admitted through the orifice at an average rate of 630 ml per hr. Solution temperature was held at 98-101 F. The solution was allowed to remain in contact with the copper surface for one hour and was then drained at a rate of about 960 ml per hr. The tube was then filled with rinse water twice and allowed to soak for one hour before draining.

Limiting Contact Time

In order to remove the copper remaining in the tube, two additional treatments with copper solvent were made employing rapid filling and draining, and limiting the contact time to two hours in each case. The following data were obtained from analysis of the three copper solvents:

Solvent No. 1 3.22 grams copper
Solvent No. 2 4.62 " "
Solvent No. 3 0.128 " "
Unaccounted for 0.252 " "

Corrosion of the tube after removing solvent No. 1 was somewhat greater than previously observed, and during draining the surfaces dried, leaving a blue film of the copper complex that was insoluble in the rinse water. This film may have increased the copper content of solvent No. 2, which contained more copper than was usually found.

From the data secured, the solubility of copper in the persulfate solvent was estimated to be 1700 ppm or 0.17% under the test conditions of filling, soaking and draining as previously described, these conditions being comparable to those under which the boiler would be cleaned.

An estimate of the total quantity of copper in boiler "A" based on deposits turbined from tubes indicated about 150 lb were present. The volume of the boiler is about 33,000 gal. This quantity of copper solvent consisting of 0.75% ammonium persulfate, 1.4% NH_3 and 40 ppm of sodium hydroxide was believed to be capable of dissolving 0.17% or 470 lb of copper, which had deposited.

The boiler was first acid cleaned with 7.5% inhibited hydrochloric acid, the soaking period being 6 hr with initial and final metal temperatures of 145-165 F and 135-155 F respectively. The acid was then displaced with nitrogen as were the two subsequent water rinses. During these rinses the boiler temperature was adjusted to 100 F maximum. The copper solvent was then pumped in over a period of about 4 hr at about 85 F and allowed to soak for 30 minutes, during which time it was recirculated out of the top and into the bottom. Draining time was 2.5 hr. The copper solvent and the two subsequent rinses were displaced with compressed air. Filtered water was used for rinsing the boiler after each step.

Copper Concentration

Samples of the copper solvent taken during the filling showed a range of copper concentration of 0.06 to 0.25% with an average of 0.16%. Analyses of the acid and the copper solvents as drained from the boiler are indicated in Table 2.

Copper in solution in the drained solvent was 300 lb, corresponding to the 0.113% concentration. This does not include that sloughed off and found mixed with iron oxide in the bottom of drums and lower headers. This mixture, which had a copper content of about 60%, was estimated to contain about 80 lb of copper.

Weights and analyses of deposits turbined from selected tubes following the cleaning operation are indicated in Table 4. It is evident that iron oxide produced by the persulfate was undesirably high but, based on before and after conditions, the bulk of the copper was removed.

An itemization of the cleaning costs totaling $10,258 are indicated in Table 3. Minor costs such as those for steam and gas for solvent and boiler heating, rinse water, compressed air and caustic soda are not indicated.

Table 3 allocates the costs to show the additional expense for copper removal over and above that for acid cleaning only. Copper removal cost $3,295 or about $11.00 per pound taken into solution by the solvent. Possibility of lower costs is indicated by laboratory data obtained after the cleaning of boiler "A" as in Table 5.

TABLE 4—WEIGHTS AND ANALYSES OF BOILER "A" WALL TUBE DEPOSITS FOLLOWING THE JANUARY, 1950 CLEANING

Bifurcated Tube Designation	Weight (Grams)	Analysis (%) Ign. Loss	Fe_2O_3	Cu	SiO_4
East wall, South 19	89	7.5	87.1	4.2	1.7
North wall, West 31	93	6.3	76.7	13.2	4.5
West wall, South 17	3	—	—	—	—
South wall, West 31	20	—	—	—	—

TABLE 5—LABORATORY COPPER REMOVAL TESTS CONDUCTED AFTER JANUARY 1950 CLEANING OF BOILER "A"

Solvent: 0.5% Ammonium persulfate
1.4% NH_3
Temperature: 75 to 80 F

	Test No. 1	Test No. 2
Weight of copper plated on tube	5.54 g	7.11 g
Weight of copper per lineal ft.	2.26 g	2.90 g
Time to fill from bottom	4 hr, 20 min	3 hr, 45 min
Soaking time	30 min	30 min
Draining time	55 min	45 min
Total time, start of fill to end of drain	5 hr, 45 min	5 hr, 0 min
Copper removed	4.24 g	3.67 g
Copper concentration in solvent	0.223%	0.193%

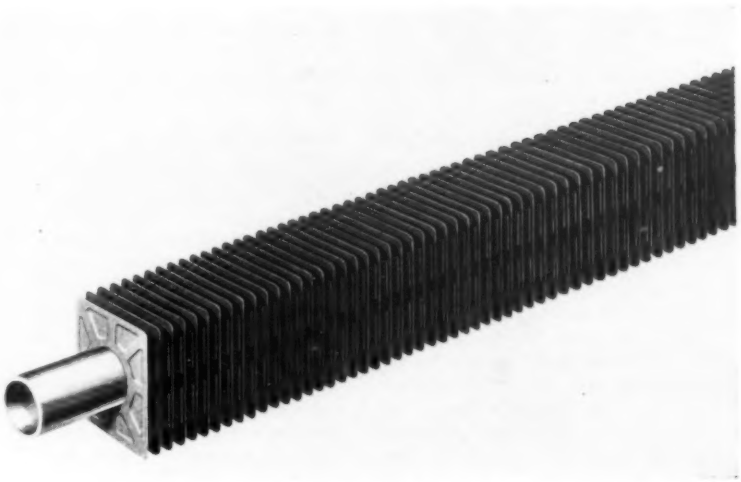
FACTS AND "KNOW HOW" ON WALL-PANEL RADIATION

Development of finned-tubing radiation, system design and selection is made available for plant engineers, who are responsible for all heating apparatus. No floor drafts are apparent

E. W. FRIEND,
Application Engineer,
Fedders-Quigan Corp.

MANY PLANT ENGINEERS are faced with the problem of replacing old, inadequate heating systems and required to design and recommend heating systems for new plants or office additions. The purpose of this article is to explain the theory, application, and use of so-called "blanket" type heating commonly known as wall or finned tube radiation.

This type of heating is not new as the old inefficient pipe coil system partially did blanket exposed walls. These units were usually spread over wide outside wall areas and did a fair job of heating. Cold infiltrating air was warmed before it came in contact with room occupants. According to the heating requirements and standards of today, engineers would not think of installing this cumbersome, expensive and seemingly obsolete type of heating.



Finned-wall radiation tubing occupies little space for each EDR. Fins are pressed to the tube for a tight bond

Radiation Comparison

Comparison for approximately equal outputs of heating equipment is indicated in Table 1. Modern wall radiation offers more heat units for less occupied space than four other types associated with this form of heating.

Approximately 25 years ago a series of laboratory tests were made for the purpose of obtaining a more comfortable and efficient type of heating. First the common type of cast iron radiator was analyzed. The long low radiator was established as maintaining a more comfortable room than the high type radiator of equal capacity. Temperatures at various test room heights definitely showed that the difference between the floor and ceiling was considerably lower for the lower radiator. Temperatures at different room locations did not vary to any extreme.

Another observation made was that when a low radiator was located along a cold outside wall beneath a window, cold drafts were not as noticeable. Secondly, when this same radiator was located along an inside wall, cold drafts were very noticeable plus a larger differential between floor and ceiling temperatures. Of course, warm air rises and cold air descends. Infiltration air through windows and cold air along outside walls descend to the floor level. This mixture moves across the floor to an inside wall radiator, is heated, and rises to the ceiling. The resulting cold floor draft makes the room decidedly uncomfortable because the lower portion of an occupant becomes chilled.

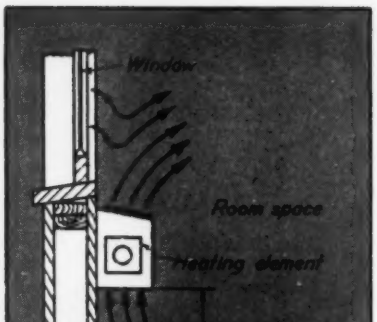
With this low radiator located under the outside wall window, heated air rises to the ceiling, descends along the inside wall, and returns along the floor to the radiator. At the same time cold air flowing down along walls and leaking in around windows is preheated and rises towards the ceiling. This action prevents the largest portion of the cold air from descending and moving along the floor, thus giving a more comfortable room at a lower average temperature throughout the space.

Numerous tests over the years have been conducted with the above basic idea in mind, to obtain a better heating distribution along with improved comfort, economy of operation, convenience and general appearance. Results of this research indicated a form of "blanket heating" installed along the entire exposed area—utilizing the principle of convected heat—will warm the air and gently circulate it.

Equipment of this type is now known as wall finned tube heating. Over the

TABLE 1—COMPARISON CHART OF HEATING SYSTEMS FOR APPROXIMATELY EQUAL RATINGS

Name of system	*Unit Size* Width, in.	*Unit Size* Height, in.	Length, in.	*Space required* cu in.	Btu/hr output
1¼ in. fin tube wall radiation	3½	3½	60	735	5,800
3-section cast iron wall hung radiator	3	22	40	2630	5,040
7-section cast iron floor type radiator	20	20	18	7200	5,040
1¼ in. bare pipe coil—8 tubes high	1½	30	60	1350	4,535
1¼ in. bare pipe coil—5 tubes wide	18	1½	60	1630	4,625



Warm, rising air mixes with cold down draft, return air flows along floor

past ten years it has been thoroughly tried and tested in many industrial and commercial buildings, hospitals, schools, railroad cars, offices, apartments and homes. Generally located from 6 to 18 in. above the floor level and along the entire exposed wall area, it may extend a few inches into the room, or may be entirely recessed in the walls. Furthermore, little wall or floor space is required. It is looked upon by many as the answer to a long, low heater that produces a floor to ceiling differential of approximately 2 degrees and eliminates floor drafts.

Main component part of the wall radiation is a finned tube element and cabinet. The heating element is made up of a series of metal fins tightly bonded to a metal tube. This type of construction is based on the theory of using a large amount of secondary surface (fins and outside tube area) as compared with the primary surface (inside tube area). The tube is generally made of cold drawn seamless steel or copper. Fins are made of light gage steel, copper or aluminum. A die formed pattern embossed in the fins adds strength and increases fin efficiency by causing a turbulent scrubbing action to be set up in the air stream for good heat transfer.

Fins are formed with integral collars to provide heat transferred from tube to fin, and, therefore, element rating is improved. Fin to tube assembly is accomplished by placing fins — with oversize holes—in a trough, slipping a length of tube through the holes, and expanding the tube into the fin collared hole to obtain an efficient mechanical bond. Fins are uniformly spaced on the tubes by means of the fin collar.

Cabinet Design

Cabinets must be designed to allow air circulation over the heating element, direct heated air correctly into the room, control the cold air descending along the wall and protect the occupants from direct contact with the finned element. The assembled elements are supported on wall brackets spaced approximately 4-ft apart. The elements should be slightly pitched to permit drainage of condensate when using steam or to provide a high point for air venting when circulating hot water.

For good installation practice, runs should be limited to 100 lineal ft for a 1 psi pressure drop, and a maximum of 150 lineal ft for greater pressures. On the longer runs a movable type bracket should be installed to allow for expansion. Fixing one end of the element is a good policy, and expansion will occur in only one direction.

Individual runs should be connected to separate traps to obtain maximum system efficiency. For hot water, automatic vents should be installed at every high point. Installation of eccentric type reducer fittings is highly recommended for connections involving pipe size change. With the eccentric portion of the fitting on top the air pocket along the larger size pipe length is eliminated. Whenever floor loops are planned, drainage with a plugged tee instead of the usual 90° ell is advisable for better maintenance.

Method of Selection

Steam or hot water can be utilized as the heating medium for wall radiation. Final heating medium choice in a large measure is determined by local installation conditions. Before the actual system can be specified the hourly heat losses must be determined, and the Btu method is recommended. The following procedure seems to be the simplest to follow.

(1) Select inside temperature to be maintained based on the use of building. This is called design temperature.

(2) Outside design temperature, for the majority of structures, can be taken as 15 F above the lowest temperature recorded in the surrounding locality.

(3) Subtract outside temperature from inside temperature to obtain the design temperature difference.

(4) Compute the square foot areas of all exposed walls, doors, glass, roof and floor.

(5) To obtain the heat loss for each type of construction the following formula is used:

$$\text{Btu/hr} = K \times A \times TD$$

Where, Btu/hr = heat loss per hr
K = coefficient of heat transmission for the material involved.
A = sq ft of exposed area
TD = design temperature difference

(6) Heat losses resulting from air infiltration are usually based on one or two air changes per hour. For one air change:

$$\text{Btu/hr} = \text{cubage} \times 0.075 \times 0.24 \times TD$$

Ventilating fans in a building increase the normal air change. Compute the heat loss resulting from fans by the following formula:

$$\text{Btu/hr} = \text{cfm exhausted} \times 60 \times 0.075 \times 0.24 \times TD$$

(7) The sum of the heat losses in 5 and 6 will give the normal amount of heat required. Heat-treating furnaces and drying ovens may be deducted if they are operated over long periods of time. As a safety factor it is well to add 10% to the result.

Design problem on a wall-radiation system heated with finned tubing:

Steam or hot water can be used as the heating media. Selection will be determined to a great measure by the local installation conditions. For the purpose of this design the existing low pressure steam system pressure average is 5 psi.

The sub-assembly room is an addition to be made to the existing plant.

TABLE 2—STEAM CAPACITY PER FOOT OF LENGTH

	Rows high	Less enclosure		Enclosure Type EM		Enclosure Type FT		Enclosure Type ST	
		Btu/hr	EDR	Btu/hr	EDR	Btu/hr	EDR	Btu/hr	EDR
1¼ in. Pipe 50 Fins Per Ft	1	1410	5.87	1350	5.63	1370	5.70	1390	5.80
	2	2540	10.60	2440	10.16	2800	11.67	2920	12.18
	3	3380	14.10	3240	13.50	4060	16.90	4220	17.55
	4	4520	18.85						
1¼ in. Pipe 38 Fins Per Ft	1	1160	4.84	1115	4.65	1130	4.70	1140	4.75
	2	2085	8.70	2015	8.42	2295	9.56	2400	10.00
	3	2780	11.60	2670	11.12	3340	13.90	3470	14.45
	4	3710	15.45						
2 in. Pipe 24 Fins Per Ft	1	1390	5.80	1335	5.55	1350	5.62	1360	5.67
	2	2500	10.40	2400	10.00	2750	11.45	2880	12.00
	3	3320	13.82	3190	13.30	3990	16.60	4140	17.25
	4	4440	18.50						

Note:—240 Btu = 1 EDR. 60F Entering air. 1 psi steam.

All pertinent heat transfer data involved in the determination of the heating requirements are as follows: roof, .28; brick wall, .36; and glass, 1.13. These "k" or heat transmission factors were obtained from the Heating and Ventilating Guide Book. They also appear in numerous catalogs on heating equipment as well as various standard engineering handbooks.

Design Procedure

Workers in this room will be women ranging in age from 18 to 50. They will be seated along rows of tables, assembling small parts. For these conditions the heating system must be designed free from drafts and above the average 65F normally used in factories. From these basic facts the following assumptions and calculations were obtained:

(1) Design temperature of 70F was selected as all work to be done in the area requires a very small amount of physical effort, and the occupants will be seated most of their working hours.

(2) Lowest outside recorded temperature in this area was -15F. Therefore, 0F was assumed as the outside design temperature.

(3) Design temperature difference is (70 — 0) or 70 degrees.

(4) Exposed areas:

Glass — 16 x 10 x 12	=	1920 sq ft
Wall area:		
South = 26 x 15 ft	=	390 sq ft
East = 100 x 15 ft	=	1500 sq ft
North = 72 x 15 ft	=	1080 sq ft
West = 100 x 15 ft	=	1500 sq ft
Gross wall area		4470 sq ft
Less glass area		1920 sq ft
Net wall area		2550 sq ft
Roof area = 100 x 72 ft	=	7200 sq ft

Note: Floor area, door area, and part of the south wall are not computed as they are adjacent to heated areas of the same temperature.

(5) Heat loss of exposed areas:

Glass = 1,920 x 70 x 1.13 = 152,000 Btu/hr
Walls = 2,550 x 70 x 0.36 = 64,300 Btu/hr
Roof = 7,200 x 70 x 0.28 = 141,000 Btu/hr

(6) Air infiltration:

72 x 100 x 15 x 0.075 x 0.24 x 70 = 135,900 Btu/hr

(7) Total heat loss:

Glass	= 152,000 Btu/hr
Walls	= 64,300 Btu/hr
Roof	= 141,000 Btu/hr
Air	= 135,000 Btu/hr
Total heat loss	= 492,300 Btu/hr
Add 10%	50,000 Btu/hr
Heat required	= 542,300 Btu/hr

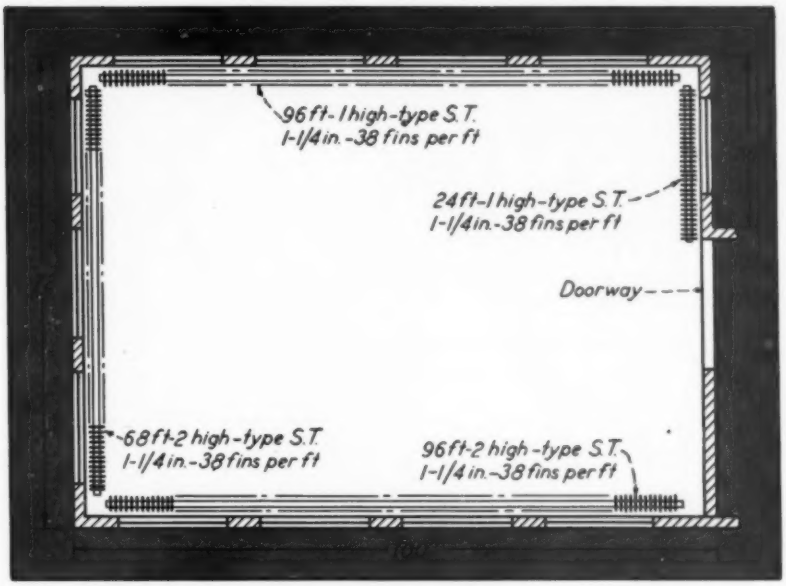
(8) For wall length available for pipe connections and expansion of the heating elements deduct 2 ft from the inside dimensions along the east, west, and north walls. For the south wall deduct 1 ft. The remaining inside wall length is therefore, 284 ft. This amount is available for blanketing the exposed areas with wall radiation.

The sloping top type of cover indicated for this installation is made of 18 gage steel, affords protection for employes and heating elements, and prevents an accumulation of debris on the top. An assumed northwest prevailing wind indicates a 2-high type of element and cover should be installed along the north and west walls. The available wall length for radiation is 164 ft. Along the east and south walls 120 ft are available and a 1-high type element and cover should be used if at all possible and if practical.

Consulting the wall radiation rating Table 2, a 2-high 1-¼ in. element with 38 fins per foot in an ST cabinet has a rating of 2,400 Btu per foot of length. Using the correction factor of 1.02 from Table 3 for 5 psi steam at 70 F, the true rating of this element is 2,450 Btu per foot. For a 1-high 1-¼ in. element in a sloping-top cabinet the rating is 1,140 Btu and corrected to standard conditions is 1,165 Btu per foot.

Figuring the 2-high element for the north and west walls, a total of 164 ft x 2,450 Btu per ft=402,000 Btu per hour will be supplied. For the east and south walls a total of 120 ft x 1,165 Btu per foot=140,000 Btu per hour will be supplied. This results in a total of 542,000 Btu per hour that will be supplied as compared with a requirement of 542,300 Btu per hour.

From the above calculations the plant engineer will show on the sketch of the room the location of the heating equipment, the size, type and length required, so it will be installed as planned. This gives best results.


96 ft-1 high-type S.T.
1-1/4 in.-38 fins per ft
24 ft-1 high-type S.T.
1-1/4 in.-38 fins per ft
Doorway
68 ft-2 high-type S.T.
1-1/4 in.-38 fins per ft
96 ft-2 high-type S.T.
1-1/4 in.-38 fins per ft

Sub-assembly room layout with radiators located along outside walls. Two row tubes protect the north and west walls

TABLE 3—STEAM CONVERSION FACTORS

For determining capacities for various steam pressures and entering air temperatures (based on standard conditions of 1 psig steam pressure and 60F entering air temperature)

Steam pressure psig	Steam temp, F	Entering air temperature 50°	55°	60°	65°	70°	75°	80°
0	212.0	1.06	1.03	0.98	0.94	0.90	0.86	0.82
1	215.0	1.09	1.05	1.00	0.96	0.92	0.88	0.84
5	227.2	1.19	1.15	1.10	1.05	1.02	0.98	0.94
10	239.4	1.29	1.25	1.21	1.16	1.13	1.08	1.03
15	249.7	1.40	1.35	1.30	1.26	1.22	1.17	1.13
20	258.8	1.48	1.42	1.38	1.35	1.30	1.26	1.21
25	267.0	1.55	1.50	1.46	1.42	1.37	1.33	1.28
30	274.1	1.62	1.57	1.52	1.48	1.43	1.39	1.34
40	286.7	1.73	1.69	1.63	1.59	1.54	1.49	1.45
50	297.0	1.83	1.79	1.74	1.69	1.65	1.60	1.55
60	307.3	1.92	1.88	1.84	1.79	1.74	1.69	1.64
80	329.9	2.09	2.05	2.00	1.95	1.90	1.85	1.80
100	337.9	2.24	2.19	2.14	2.08	2.04	1.98	1.94
125	352.9	2.39	2.34	2.29	2.24	2.19	2.14	2.09
150	365.9	2.54	2.49	2.43	2.38	2.34	2.28	2.23

Fig. 1—Test set for portable tools with a third wire ground may be installed in tool-crib window. Continuity tests are quickly made by inexperienced clerks

Test Equipment that Promotes

SAFETY FOR PORTABLE TOOLS

H. T. DUPLICE, ***Superintendent,*** **and R. C. ALEXANDER,** ***Mechanical Engineer,*** ***Harbor Steam Plant,***
Department of Water and Power, City of Los Angeles

PERHAPS the most significant step toward reduction of electrical shock hazard has been the use of the 3-wire connector plug system to provide a ground connection to the frames of portable electric tools and extension-light guards. The system provides automatic grounding with a 3-post connector plug, the third post connecting the tool frame to ground via a third wire in the tool cable. This obviates clipping a ground wire to the nearest, and possibly a high-resistance and questionable, ground, and it is impossible for the operator to forget a ground connection. When the job is completed he simply removes the plug, opening both power and ground circuits. The next user makes his ground connection when plugging in.

The importance of this can be gaged by noting the large number of industrial and governmental organizations, which do not recognize the use of ground clip protection.

Workmen using tools and lamps employing the 3-wire grounding plug system have come to place a high degree of reliance on the method. It protects them against unpleasant, injurious or fatal electrical shocks, not only under normal conditions, but also under such hazardous conditions as extreme wetness, where low electrical resistance through the user's body to ground may prevail.

This reliance has required schedules of frequent inspection and testing of equipment to insure continuity of the ground circuit conductor, and its connections to the tool frame and connector plug. The severe physical services to which most industrial tools are subjected frequently result in (1) broken or pulled out wires, (2) broken connector spade pins, (3) crushed and shorted conductors and (4) damaged insulation. This may not be evident on visual inspection but is extremely hazardous to the tool user.

A review of the safety inspection practices employed by a number of larger industrial and governmental organizations reveals a lack of uniformity in the tools and methods employed and a wide variance of schedules for periodic inspection. Some plants were shown to test at intervals of 30 days or longer. At least one made an inspection after each usage, obviously reducing tool availability to an alarming degree. Testing methods, tools and techniques showed a wide variation, from a casual visual inspection to the extremes of continuity tests with meggers or meters.

Upon recognizing the importance of such inspections and after analyzing the practices of others, an attempt was made to provide adequate, realistic and workable standards for the frequency and methods of electrical safety inspection for tools.

In this study it was reasoned that a ground-conductor failure would normally occur during actual use of the tool or while being unplugged after usage. If then undetected, it would be

desirable that the tool be tested immediately following use, or immediately prior to issuance from the tool crib. Lack of testing after each use would almost completely nullify the value of the ground cord or greatly reduce its dependability.

Based upon this premise, we designed test equipment for the routine tool-crib testing of portable tools by electrically untrained employes. Such test equipment had to be simple in operation, positive in its findings and rapid enough to avoid the 4 o'clock tool-crib bottle-neck. The resulting equipment is shown in Fig. 1. Mounted at the crib window, the clerk may quickly check every electrical tool before returning it to stock.

How Method Works

Standard procedure for safety inspection is now as follows:

When any electrical tool is returned to the crib, it is placed on the metal top of the tool-crib counter. The tool keeper plugs its connector into the test box. While in full view of the workman, he throws the test switch to *position, 1,* where a green pilot indicates continuity of the safety grounding circuit from the plug, through the cable to the tool frame, and to the metal counter top connected to the ground circuit of the tester. If the green pilot does not light, the tool is immediately tagged "unsafe" and given over to the electrical department for inspection and repair.

While the switch is still in *position 1,* lighting of the red pilot indicates that one of the power wires has come in contact with (a) the ground circuit or (b) the tool frame. It is therefore unsafe and must be inspected and repaired by an electrician. Both of these tests are made at a potential of 6 v a-c and are therefore entirely safe.

If the tool successfully passes the above inspections, the test switch is thrown to *position 2,* which applies the full 110 v a-c to the power leads and solid ground to the 3rd wire. Continuity of the power circuit is then demonstrated by operation of the tool, and inoperativeness results in the tool being tagged "inspect for operation". The subsequent inspection by an electrician will reveal the cause of failure and result in good repair.

By conducting these tests in full view of both the tool keeper and user, a double check is made and assurance of test and safe condition is automatically provided for the next user. The excellent psychological effect of this visual method of tool counter testing results in increased consciousness of safety precautions for the workman. Greater voluntary attention is a natural result and it will bring a marked reduction of probable shock hazards.

The tool keeper may, at his discretion, tag any tool that, upon examination, appears to require maintenance due to a faulty mechanical condition such as a torn cable cover, defective plug, poor switch or tool action. Such tagging places the tool in the hands of a qualified electrical repairman for the indicated repair.

The particular tester devised and in use is shown in Fig. 2. It represents but one of numerous possible combinations for accomplishing the described test.

The schematic electrical diagram in Fig. 3 represents an inexpensive assemblage of parts which gives adequate test results. Certain circuit and component refinements are possible and may be incorporated, depending upon the designer's point of view. If desired, the two lamps, which indicate respectively an open ground lead and a power lead shorted to ground, may be replaced by high-resistance voltmeters. The meter scales can be calibrated to show the respective circuit resistances, and colored for safe or unsafe circuit resistance conditions.

Possible Variations

Another possible refinement is the use of a 4-pole, double-throw switch utilizing the fourth set of contacts to open and close the 110 v a-c line, eliminating the lineswitch shown. Numerous variations, such as audible alarms, make many interesting design possibilities.

Not shown in the photograph, but important to the over-all performances of the tester, is a momentary contact, SPST pushbutton switch for the purpose of testing the indicator light, thereby avoiding a faulty negative indication of power short to ground. This switch is included in the circuit diagram.

One of the important items making this unit successful is the metal counter-top at ground potential for completing the third, or ground wire test circuit. Eliminating the need of a test-prod or clip for this connection simplifies the procedure and encourages its constant use. It is very easy for the tool-crib attendant to make safety tests as a routine part of his tool-dispensing job. Tool availability is not reduced unnecessarily by ordinary testing.

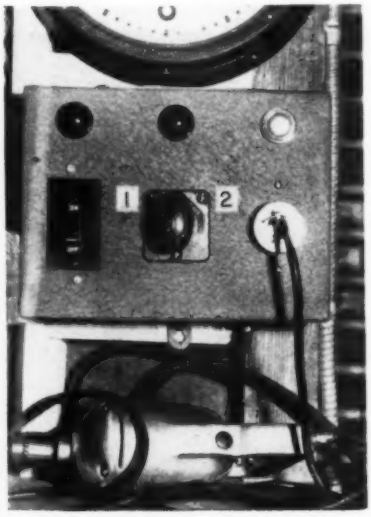


Fig. 2—Steel bench top connected to tester makes ground circuit to tools

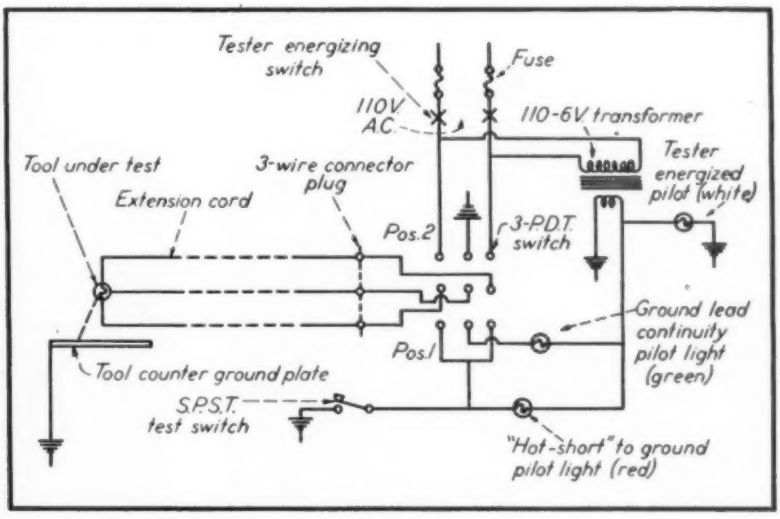


Fig. 3—Schematic diagram of tester shows connections for ground continuity tests at a safe six volts, followed by full-voltage operating test for tools

ELEVATORS AND CONVEYERS SPEED OPERATION OF NEW SOYBEAN PLANT

This new soybean oil extraction plant, located in the heart of the Ohio soybean field, has a capacity of processing 70 to 80 ton each 24 hours. Horizontal-conveyers and vertical-elevators work together to supply beans to the flaker, remove and carry them to extractors and dryers and finally to the meal preparation house

DELPHOS Grain & Soya Products Co. plant at Delphos, Ohio, has a 212-ft high headhouse that towers 112-ft above its grain storage silos. These silos have a combined holding capacity of approximately 750,000 bu. Conveying equipment supplied by Link-Belt Co. includes a double-leg bucket elevator (209-ft center) operated by a 60-hp motor. Grain is picked up from the conveyer belt in the sub-basement and lifted to the headhouse top. From this point the elevator discharges the grain into a 3,000-bu hopper scale, which in turn feeds into a pair of 3,000-bu bins serving the cleaners.

An automatic scale (25 bu capacity) weighs the cleaned grain and discharges it to a 36-in. wide conveyer belt and tripper. A 36-in. wide belt conveyer is employed for reclaiming grain from the silos. This arrangement of hoppers and scales permits maintaining an inventory of clean grain in the house at all times. Other equipment includes a large dryer; a thermometer system for automatically recording temperature of grain in storage; car unloading equipment; car pullers; a 50-ft long hydraulic truck-dump; and a 50-ton capacity recording scale.

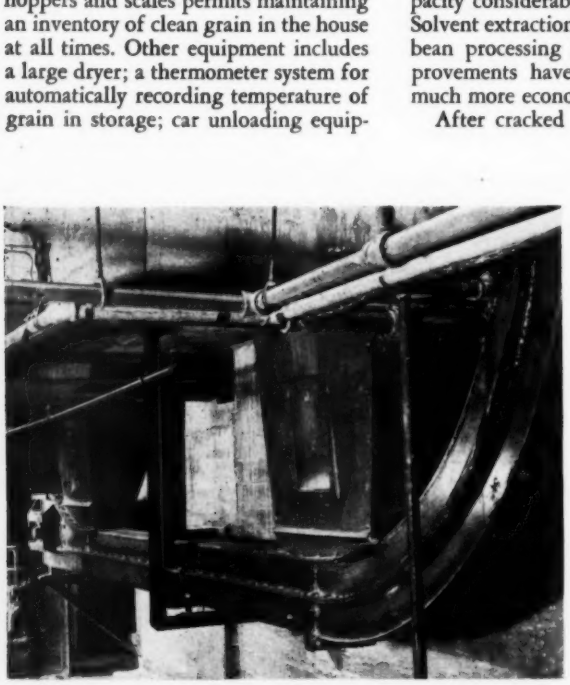
Situated between two railroads the plant has trackage to handle up to 40 or 50 carloads of grain and soybeans daily. Furthermore, it is well equipped and ideally located to serve one of the nation's heaviest soybean producing areas. Over 18,000,000 bu of beans are grown annually in a 50-mile radius and as far west as Indiana. The solvent extraction unit, manufactured and installed by The V. D. Anderson Co., Cleveland, Ohio, has a capacity of 70-80 ton of soybeans per day of 24 hours and was placed in operation in February, 1949.

Rated capacity was attained in a short time with a resulting high quality of oil meal. Production has since been stepped up to 110 ton per day, and the Delphos firm is planning to increase this capacity considerably in the near future. Solvent extraction is not new to the soybean processing industry but late improvements have made the operation much more economical.

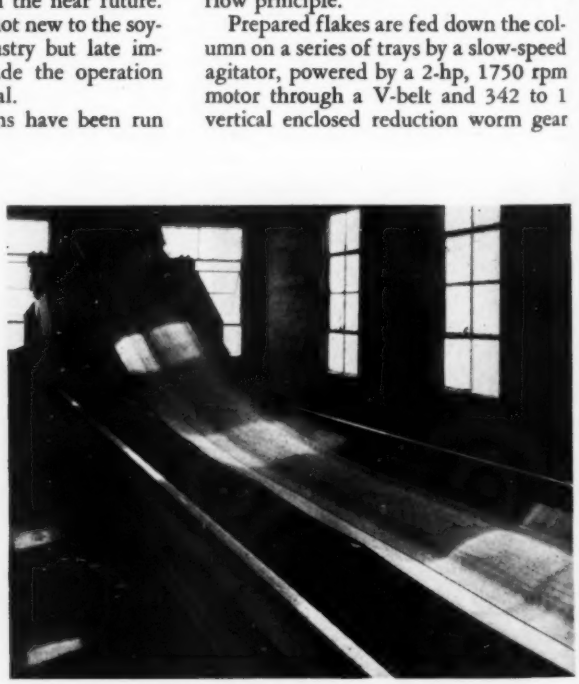
After cracked beans have been run through a bean heater and steam condenser to reduce them to a plastic state and proper moisture content, they are fed by an overhead screw conveyer into two 24x40-in. flaking rolls. These rolls flake the beans to a thickness of 8 to 10 thousandths of an inch. Flaking the beans provides an easier way for the solvent to remove bean oil.

Bean flakes from the flakers are discharged through the floor to a horizontal leg of an L-path conveyer-elevator and raised above the main roof of bean preparation building. This unit has a horizontal run of 25 ft with two feed inlets and a vertical leg of 36 ft. It discharges at the top of the lift onto an insulated horizontal 179 ft over-all length conveyer. Flakes are then carried directly into the top of the extraction column in the plant yard. The extraction column is operated on the conventional counter flow principle.

Prepared flakes are fed down the column on a series of trays by a slow-speed agitator, powered by a 2-hp, 1750 rpm motor through a V-belt and 342 to 1 vertical enclosed reduction worm gear



Chutes discharge flaked beans onto the horizontal run of a conveyer-elevator that carries them to other processing units



Roller-bearing conveyer (36 in. wide) and traveling tripper operate on troughing type idlers supporting the flat belt

drive. A late improvement to this extraction column is the addition of adjustable tray openings. This gives the operator an extra variable control.

Squeezing Process

Extracted flakes are carried from the extraction column foot in a specially designed column discharge device designed along the principle of the Anderson "Expeller." In this unit much of the solvent is squeezed from the spent flakes, thus effecting a substantial saving in steam necessary in the solvent recovery process from the flakes.

This column-discharge device delivers material to a run-around path conveyer, that is separately operated by a 10-hp motor through an enclosed variable speed drive and double-width precision steel roller chain. Any desired rate of spent flake discharge can be obtained. The unit is operated remotely from a control room in the bean preparation building. The run-around conveyer follows a rectangular path of 14 ft horizontal by 31 ft vertical. Furthermore, this combination elevator-conveyer delivers spent flakes into the top unit of a bank or horizontal solvent recovery dryers (desolventizers) equipped with agitators. Here the small amount of solvent remaining in the meal is removed. These dryers and run-around units are operated from a 10-hp motor through a triple-reduction enclosed herringbone gear drive and precision steel roller chain.

Desolventized meal is discharged from bottom dryer drum to an L-path conveyer-elevator that has a horizontal run of 19 ft and a vertical leg of 35 ft. Discharge is into the foot end of an overhead horizontal conveyer—194-ft over-all length—extending to an outdoor pressure-cooker toaster assembly unit and on into a meal preparation building for further processing.

A bottom outlet in a long horizontal conveyer permits discharge into steam pressure toaster, where the meal is cooked under pressure. The soybean meal is fed continuously into and out of the toaster through pressure locking devices.

Toasted meal is discharged from the pressure-cooker by gravity into the meal coolers directly below. Cooled meal is conveyed by an enclosed horizontal screw feeder and vertical lift to another horizontal 194-ft long conveyer and carried into the preparation building. Meal is then ground and bagged.

Conveyer Application

Mechanical conveyers are widely used in solvent-extraction plants, and they are especially popular for handling raw bean flakes with little breakage. The single unit, self-feeding, self-discharging elevator, conveyer and feeder combination is the simplest and most versatile enclosed elevating, conveying unit for handling flowable material in a continuous mass.

Conveying medium consists of an endless conveyer chain fitted with either peak-top or straight cross-flights. It operates slowly within dust-tight casing and handles material gently with a minimum of breakage, degradation, dusting or contamination.

Flights, that fill practically the entire area of the casing in which they move, form a series of compartments that hold material. Operation of chain and flights within the casing causes material to be conveyed to the discharge point. Openings for feed, access and discharge are provided in casing.

Extraction column where the solvent is removed. After the squeezing process flakes pass to solvent recovery dryers

DON'T CLIP — DON'T TEAR

WRITE FOR TEAR SHEETS!

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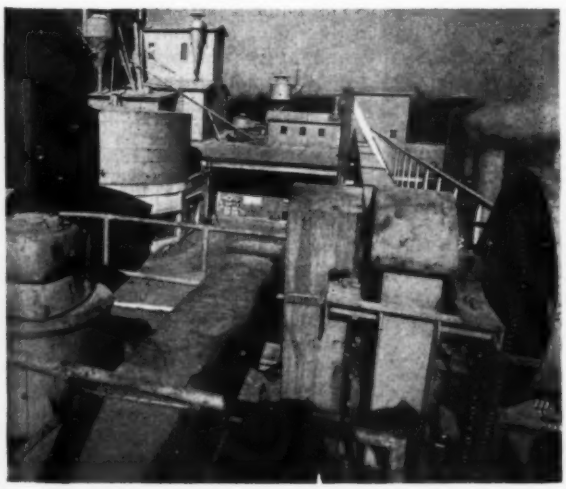

Conveyer between bean preparation building and extraction tower is powered with a worm-gear connected 2-hp motor

Soybean flaking machine is fed by an overhead screw conveyer. Flake is discharged to basement bulk conveyer-elevator

BEARINGS WILL GIVE LONG SERVICE — IF

First step in understanding bearing problems is the ability to identify the various types and know their application

a systematic maintenance program is set up along with regular inspection tours; lubrication is done properly, making sure the right amount of oil or grease is added; and maintenance men are instructed to notice bearing warning symptoms and their causes

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Engineer-in-charge,
Norwood Motor Section,
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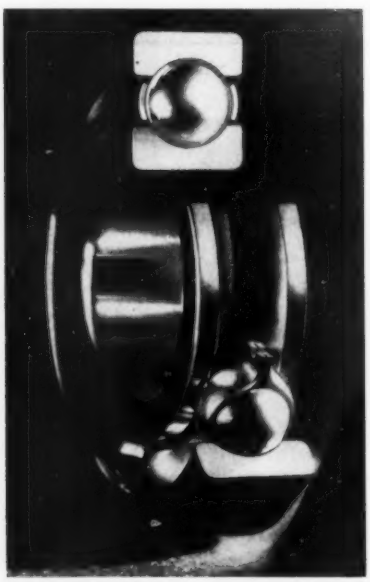


Ball bearings absorb momentary shock without injury, and they are ideal for general service and light operations

LIKE ALL MANUFACTURERS of powerhouse equipment, motor manufacturers emphasize continuity of operation in the motors which they supply for various powerhouse uses. The importance of bearings in maintaining reliable, continuous service, can hardly be stressed too highly. Bearings, along with insulation (and brushes of d-c motors) are the only major perishable elements of electric motors and are consequently responsible for a great share of any troubles.

Auxiliary motors operated in powerhouses can be roughly divided into four groups. The first group comprises the one to 15 hp range, covered by NEMA frame size 203 to 326, that serves miscellaneous plant equipment. A second group would include motors of 20 to 100 hp, such as might be required to drive small fans, pumps and conveyers. Their size, in terms of NEMA frame numbers, would be 364 to 505. Above this range, pulverizers, forced and induced draft fans and other applications of moderate speed motors up to 1,000 hp would cover a third group. The fourth group would be the large high-speed motors, which drive boiler feed pumps, at 3,600 rpm.

Utilization of anti-friction bearings in the first group, one to 15 hp, has passed through several stages of evolution in the last 25 years. Present motors in this class are rather remarkable pieces of machinery because of their long life and freedom from maintenance troubles. This results, in a large part, from the ability of sealed anti-friction bearings to stand years of continuous service without appreciable wear and without any other attention than superficial inspections. Bearing lubrication was thought to be something that had to be renewed periodically and watched all the time. But, the present-day motor of this class is equipped with bearings, which contain the exact amount of grease to give the best lubrication. Furthermore, they are sealed and are fortified against the entrance of dust and grit.

Maintenance instructions for such

motors might almost be reduced to a single rule: "Leave them alone." Then maintenance men would not have to guess what is best because hazards of operation would have been taken care of at the factory. Various users of such motors have reported general continuous operation for ten years.

Motors of 20 to 100 hp can also be furnished with anti-friction bearings of the prelubricated, sealed type. However, records of extremely long periods of uninterrupted operation are not yet available. Experience is somewhat incomplete on the sealed bearings required for shaft diameters as large as 2-7/8 in. Of course, there is every reason to believe that sealed bearings in these larger sizes will be as worthwhile and will eliminate lubricating and maintenance to the same extent as those on the smaller horsepower motors.

Visibility Preferred

Powerhouse men commonly prefer sleeve bearings for larger motors, because the bearings can be seen in action, understood thoroughly, and repaired or replaced quickly when necessary. Sometimes approaching trouble in an anti-friction bearing is hard to detect. This feature can give a false impression that the bearing is operating perfectly even up to the point where it fails completely, causing a breakdown.

A sleeve bearing, on the other hand, usually does not fail suddenly and without warning. Adherence to a regular inspection schedule, and the ease of making bearing-surface inspection detects approaching trouble before it gets serious. This makes possible the scraping, adjusting, or replacing of a bearing before the point of sudden and complete failure occurs, which might result in unexpected motor breakdown. Though the reliability of modern anti-friction bearings generally removes this objection, motors of many sizes are still available with either sleeve or anti-friction bearings.

In the third class, which includes motors for induced and forced draft fans and pulverizers, anti-friction bearings can be recommended for speeds of 1,200 rpm and less. These bearings are not available in sealed construction, and so conventional Conrad type bearings would normally be used. They are, of course, perfectly satisfactory, but they are subject to the hazard of over-greasing, which is usually the fault of the maintenance crew being too conscientious.

Cavities of ball bearings should not be stuffed to the extent that the grease is continually churned during operation. If there is sufficient space for the bearing to run free, it will clear a channel and operate at a low temperature with low friction losses. The grease charge will then occupy the space within bearing caps, and it will remain almost as firm and solid as it would be in its shipping container. Capillary flow of oil will exist from the grease along adjacent surfaces.

Excess grease can also damage a bearing by preventing the balls from turning immediately when a cold motor is started. A thick film of hard grease between the balls and retainer can hold the balls stationary for a moment on starting. This might cause them to slide on raceways and produce what the ball bearing manufacturers call "smearing." Sliding results in minute flat spots on the balls and roughened tracks in the raceways. Once started, the roughness will gradually increase and eventual failure results. Roughness and a grating noise in operation indicate this condition, and a bearing exhibiting these symptoms should be replaced before damage to the motor results.

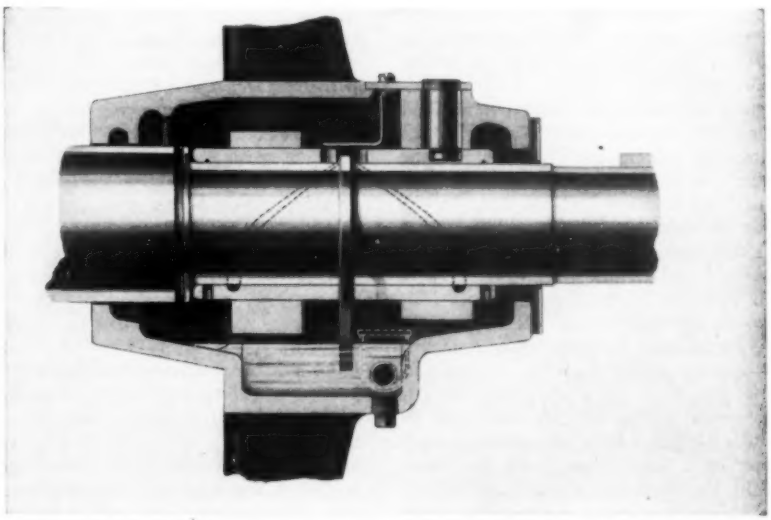
Motor manufacturers attach instructions to every ball bearing motor when it is shipped to warn against over usage of grease. In spite of this, maintenance men often thoughtlessly grease all motors on a regular schedule, and they do not take into consideration the individual needs of each motor. As a result, the bearings on some motors may become dangerously stuffed with grease, and some grease may even be forced into the interior of the motor where it is detrimental to the insulation.

Regular inspection of anti-friction bearings should, of course, be made to determine when more grease should be added. Outside bearing caps can be removed for this inspection, or they can be inspected by merely shining a flashlight into the pipe plug opening in the cap. The best grease for ball bearing operation is compounded from a soda base, has a fibrous or granular texture, and becomes liquid at temperature (only in excess) of 100C.

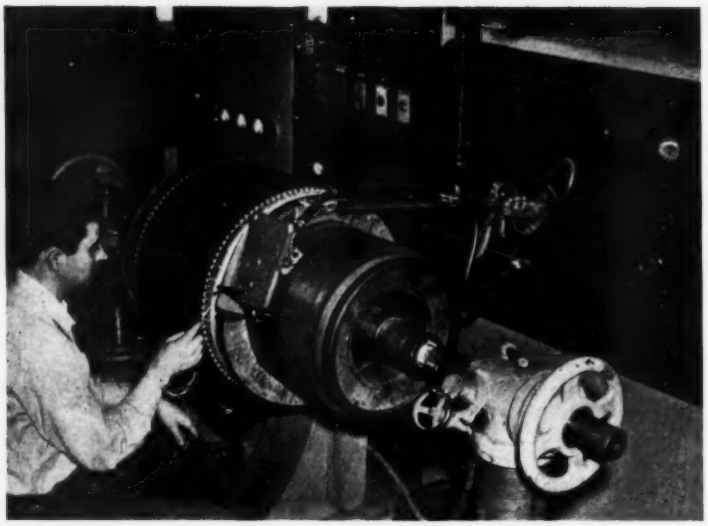
Bearing Treatment

Treatment for an over-greased bearing, which runs hot, is the removal of a large amount of the grease from the bearing cavity. In addition the motor should stand idle until the temperature is reduced to a point where the remaining grease will solidify. Usually when this is done, the bearing will again operate at its normal temperature, and give satisfactory service.

Bushing materials for sleeve bearings can be either bronze or babbitt. Bronze bushings must have sufficient strength to maintain their shape when supported by a limited outside area. However, compositions with high tin content and a smaller amount of lead are now being favored. Bearing bronze is also available backed with a stronger, cheaper metal in the form of bimetal sheets. These are largely used for bearings on small motors. Bushings of steel or cast iron tubing with babbitt linings, often centrifugally applied, are also in general use for the same class of service comparable to cast bronze bearing. In larger sizes, heavy walled shells of cast iron with the babbitt lining anchored are best suited. The babbitt may have a very high tin content to provide strength against excessive pressure and high impact. During normal loading a lead babbitt is used, that becomes permanently seated to the journal surface very quickly, and operates successfully for a long time.



Sleeve bearings are capable of carrying mild thrust loads and maximum torque during the starting operation. Suitable for large motors and heavy equipment



Here is a clean, efficient method of soldering coil leads to risers on large armatures. High-frequency induction provides localized heating, and may be used to advantage by both the manufacturers and service shops

LOREN JONES, *Engineer,*
National Electric Coil Company

Fig. 1—Risers rapidly reach soldering temperature as they pass the work coil assembly. Solder-flux paste, manual touch-up are used

SOLDERING BY INDUCTION HEATING

EFFICIENT HEATING of commutator risers on the larger types of armatures in order to solder or remove coil leads is a serious problem for manufacturers and service shops. The commutators are massive and absorb heat rapidly. High frequeny induction allows the heat to be introduced to the risers much faster than it is conducted away by the commutator bars, and provides a clean and efficient method, Fig. 1.

One of the older, more common methods makes use of an internally gas-heated soldering iron after the general area has been preheated, and possibly oxidized, by a gas torch. Another, the "hot-dip" method, is applicable to small armatures where the commutator may be immersed in the hot solder as far as the riser slots until the solder tins and fills the joints. Larger armatures are preheated several hours and lowered into the center opening of an annular solder pot. The inner rim of the pot is sealed to the commutator neck by a gasket and the level of the molten solder is then brought up to the risers and held until the joints are tinned and filled.

In induction heating, the work coil, made of water-cooled copper tubing, is placed near, or surrounding the work piece, as in Fig 2. If we imagine an outer layer of the work piece material, forming a ring roughly concentric to the coil, it may be treated as the secondary of a transformer, with the work coil the primary. Alternating current flowing in the coil produces an alternating magnetic field which in turn induces currents in the ring. These so-called eddy currents, circulating in the rings of each of the work pieces under the coil, do the heating. Copper and other non-magnetic materials do not increase the field intensity, so that a weak field must oscillate very rapidly (or at high frequencies) in order to induce the large currents which represent high rates of energy transfer.

Currents induced in the ring, or skin, flow opposite to those in the coil, and their effect is to cancel the magnetic field inside the work piece. Therefore, current is induced only in the outer surface, or ring. This is known as the skin effect. The condition, however, decreases as the temperature of the outer surface increases, causing the current to be forced to inner layers. This, together with the high heat conductivity of copper, prevents surface overheating.

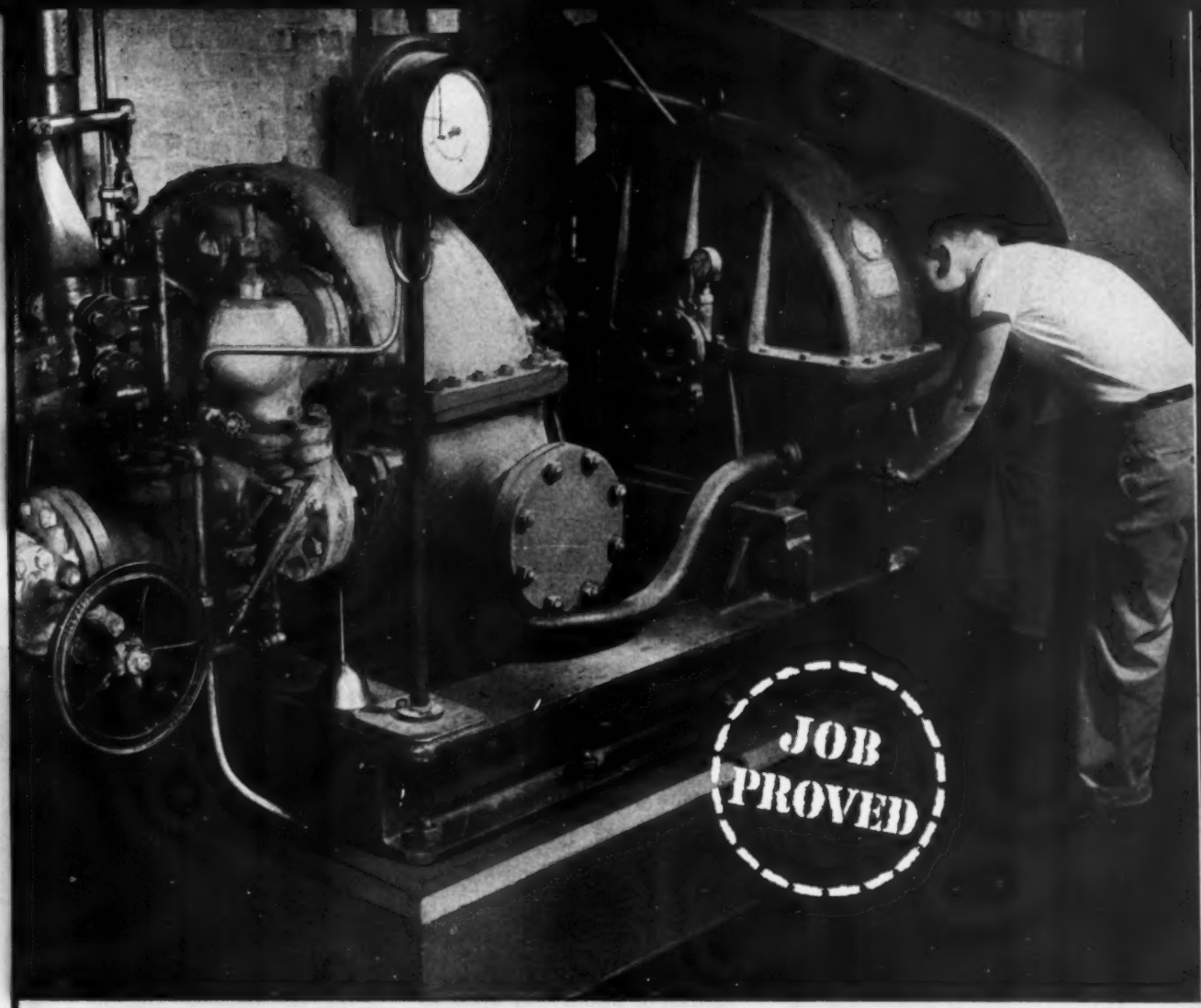
Practically the entire output of the high frequency generator is delivered into the small number of risers under the work coil. This makes it possible to progressively heat a small section of the commutator neck to the relatively high melting-point of the solder alloys designed for commutators. Temperature of the riser is controlled principally by varying the speed of rotation under the work coil.

Equally impressive is the induction heating of the risers, Fig. 2, for knocking out leads of armatures stripped of the old winding. The operation is fast and by using a jet of air, the remaining solder in the riser slot can be blown out, conveniently leaving a nicely tinned slot that requires no further attention for subsequent resoldering.

The preliminary work of preparing the commutator risers for soldering involves the usual procedure of cutting off that portion of the leads extending through the risers, and taking a light facing cut in a lathe. A combination solder-flux paste is applied to the top and face of the risers, and ordinary hard wire solder is used to touch up the individual risers, Fig. 1.

The equipment includes the high frequency generator unit and work coil, with the necessary armature mounting facilities which are sufficiently flexible in construction to accommodate the inevitable variety of armatures. Relatively few sizes of work coils are needed to heat the risers of the majority of motor and generator armatures.

Fig. 2—Removing old leads after risers are heated at coil. Air jet cleans slots



SUNVIS 900 OILS REDUCE COSTS 25%

Papermaker Gets Maximum Equipment Protection, Extra Long Service, from Superior Turbine Lubricants

In a large paper mill, eight steam turbines drive paper machines and pumps, and generate power for ventilating equipment. Ten years ago the mill began lubricating these turbines with a "Job Proved" Sun oil. They gave unfailing service with remarkably low oil and maintenance costs.

Four years ago, when Sunvis "900" Oils first became available, the Sun representative serving the mill saw an opportunity to effect even greater economy. He suggested that the medium-priced Sun oils in use be replaced by the more costly Sunvis "900" Oils. He knew that these modern, fortified lubricants—*more costly* on a per-gallon basis—would prove *less costly* through the years because of their remarkably long life. His suggestion was followed.

The Sunvis "900" Oils have fully justified this confidence, saving the mill 25% or more on lubrication costs. Furthermore, the papermaker knows his equipment—running or idle—is fully protected from rust and corrosion.

Sunvis "900" Oils are *good for the life of your production equipment.* Coupled with the know-how of the Sun representative who calls on you, they are good for your pocketbook, too. For more information, send for a copy of the illustrated booklet "Sunvis '900' Oils." Write Department IP-8.

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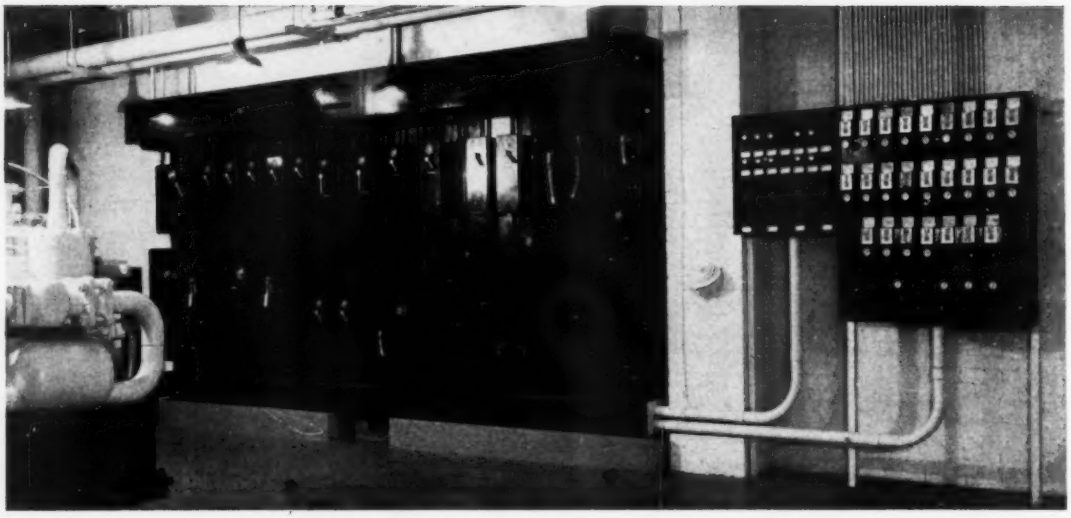


Fig. 1—Starter controls for the air-conditioning systems are concentrated in one area at left. At right are pneumatic electric switches for automatic control of the 14 zones of the main 120-ton, cafeteria and meeting room systems

AIR-CONDITIONING WITH A FUTURE

This is the method used by the Cincinnati Chemical Works to meet present requirements and still have heating and air-conditioning integrated with future expansions in their new executive office and research building

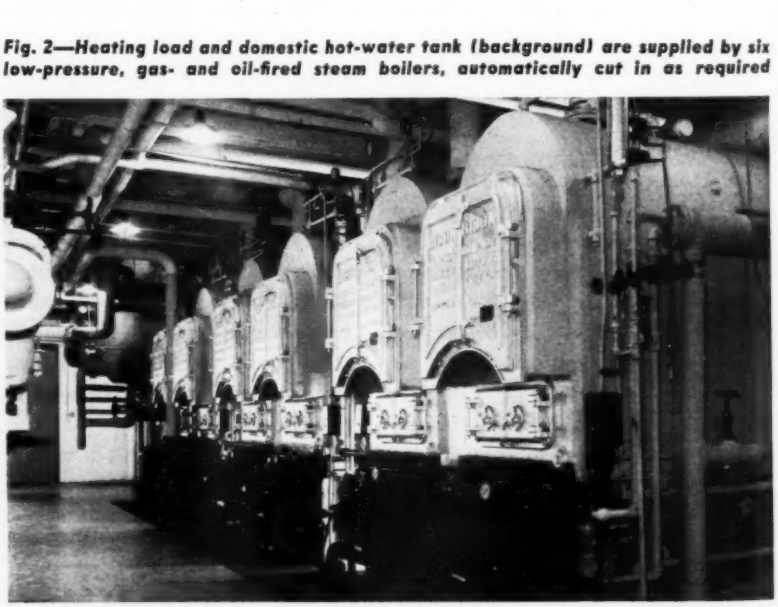
WHEN A MANUFACTURER of basic materials such as dyes and organic chemicals decides to erect new executive offices and research facilities, the long-range potentialities and possible future plans of the firm must be considered very carefully in order to assure maximum benefits from the new buildings. Such was the case with the Cincinnati Chemical Works, Inc., who recently moved into a new U-shaped, two-story and basement administration and research center. The building, designed and built by The Austin Company, is the culmination of extensive study into the future of the applied chemical research field. It has been constructed to permit easy and rapid expansion of the structure without destroying the unity and compactness of the present building.

Factors which were carefully considered during the planning stage were the possible future requirements of the heating, ventilating and air-conditioning systems. Since the building itself was designed to permit expansion by the addition of a third floor and extension of the present U-shaped structure into a hollow square, it was necessary to take these factors into consideration in laying out the initial systems. Present equipment will not only suffice for the building as it now stands, but also for a 40-ft addition to the two-story and basement administrative wing.

Erection of another story would require additional refrigeration equipment and an additional boiler in the basement, where space has been provided adjacent to the existing installations, plus a new fan room on the third floor addition to the building.

The administration wing of the building is air-conditioned by a multizone, hot- and cold-deck built-up system, while separate, smaller units pro-

Fig. 2—Heating load and domestic hot-water tank (background) are supplied by six low-pressure, gas- and oil-fired steam boilers, automatically cut in as required



vide properly conditioned air for the meeting room and cafeteria located on the ground floor. The laboratory wing is served by a separate ventilating system with fans on the roof.

During the winter months, the entire building is heated by zoned, one-pipe hot water systems using conventional convectors. The building has been divided into eight zones to assure most efficient distribution of the heat from the convectors mounted under the window sills.

The heating system for each zone contains a circulator and 3-way valve. The circulators operate continuously, while the hot water temperature is automatically varied to suit the load requirements by the zone room thermostat moderating the 3-way valve for that zone. Further control of the temperature of the hot water supply is provided by the master, outside winter thermostat, which varies the temperature of the water from 100 to 200 F for an outside temperature range of 65 to 0 F. This master thermostat also starts all circulators at an outside temperature of 65 F, to circulate the water.

Steam Supply

Low pressure steam (from 5 to 10 psi) is supplied to the heat exchanger and the heating coils of the various ventilating systems from a bank of six completely automatic steam boilers, Fig. 2, equipped to operate on either oil or gas. The boilers supply steam for the hot water heating system, as well as the various preheat and reheat coils of the ventilation system and for the domestic hot water tank and the fuel oil tank heaters. The boilers are controlled by automatic pressure controls which start and shut off individual boilers in response to the load.

Motor-operated booster pumps, Fig. 3, for each zone in the heating system are conveniently mounted on a rack at the rear of the bank of boilers. The three-way mixing valves and the heat exchanger for the systems are also located in the same area, providing a concentration of all heating equipment in one compact area.

Main Air-conditioning System

The main air-conditioning system, Fig. 4, supplies heated or cooled air in proper proportions to the entire administrative wing, except for the basement meeting room and cafeteria, which have individual units, Fig. 5.

The office section has been divided into 14 zones, each having its own set of controls. In dividing the individual rooms into zones, Austin engineers took into account such factors as: orientation of the building, contemplated load of the rooms, and periods of occupancy, etc.

The main air-conditioning system is of the hot- and cold-deck, central built-up type. It supplies filtered, cooled, and dehumidified or heated and humidified air, as required, to each individual room. The system is designed to maintain an 80 F temperature with 50 per cent relative humidity when the outside temperature is 95 F dry bulb and 78 F wet bulb. The pneumatically-operated temperature control system, working in conjunction with the outside master control, will provide a range of inside room temperatures from 80 to 72 F when the outside temperature varies from 95 to 70 F.

Each zone contains a room thermostat which controls the position of the mixing dampers to provide the proper proportion of hot and cold air to satisfy the needs of the individual zones. An additional feature is a low-limit duct thermostat which limits the air delivery temperature in each zone supply duct to 60 F in the summer and 65 F in the winter.

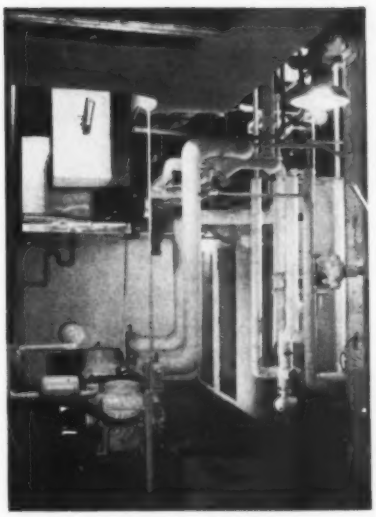


Fig. 5—15- and 30-ton air-conditioning units serve cafeteria and meeting room

Equipment for the air-conditioning system is installed in the basement area directly below the administrative offices. Refrigeration equipment consists of reciprocating Freon (F12) compressors and evaporative condensers.

Efficient operation of the air-conditioning system is assured through the use of automatic 50 per cent unloading devices on the compressors, so that they will operate in steps while the system is in partial operation. When

Fig. 3—Booster pumps and 3-way valves meet varying heat needs in each zone

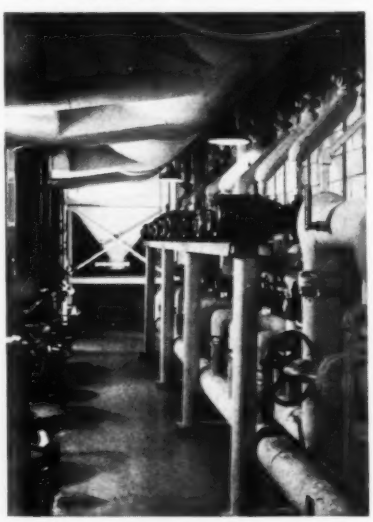


Fig. 4—Main air-conditioning is hot- and cold-deck type with two 60-ton Carrier compressors. Each of 14 zones has duct with thermometer and low-limit thermostat

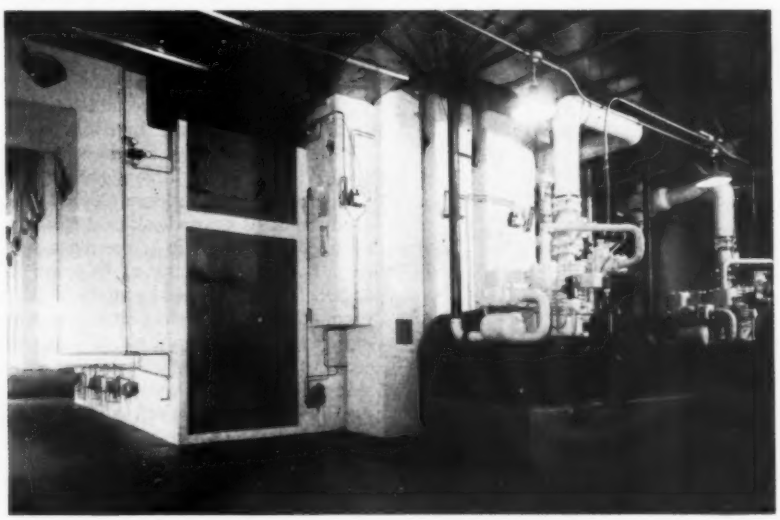


Fig. 6—Each work area, including modern executive offices, is air conditioned to suit needs. Above is engineering room

Fig. 7—Wall registers exhaust used air. Controlled fresh air, efficient lighting make the laboratories comfortable

the temperature outside is below 75 F, outside air is supplied through the system in the required amounts to keep refrigeration load at a minimum during these periods.

Low limit thermostats, indicating thermometers, and mixing damper motors are conveniently located on each supply duct for the various zones. The thermostat and thermometer have been mounted at eye level, to assist the operator in obtaining necessary operating data, while the damper motors are located at the base of each unit. Starter and operating controls for all air-conditioning systems are mounted together on one control panel adjacent to the duct work for the various zones. All incoming air is filtered and recirculated through the system.

Fig. 8—Tandem fans exhaust fumes and supply fresh air for the laboratories

Although present requirements of the system are for only 30,000 cfm, maximum fan capacity is 37,500 cfm, so that a 40-ft addition to the office wing could be served without additional air-conditioning equipment.

The relative humidity is maintained at desired levels by two duct-type humidistats. During the heating season, a humidistat, located in the main return duct, operates a diaphragm valve in the spray humidifier line located in the cold deck. During the summer months, the second humidistat, also located in the main return duct, modulates an automatic steam valve in the hot deck steam coil in conjunction with the hot deck thermostat. In this manner, a rise in humidity of the return air is detected and the steam valve moved to a new position to provide reheat as required.

Auxiliary Systems

The second air-conditioning system in the building is a factory-built air-conditioning unit which supplies air at the proper temperature and humidity to the ground floor meeting room. The refrigeration load for the system is carried by a 15-hp Freon compressor and evaporative condenser. Since this room is used sporadically, there was no need to include it in the main system. Total fan capacity of this unit is 1600 cfm. A manual switch in the room controls the operation of the system, which can supply either 100 per cent recirculated or 100 per cent outside air through the semi-automatic operation of return, relief, and outside air dampers.

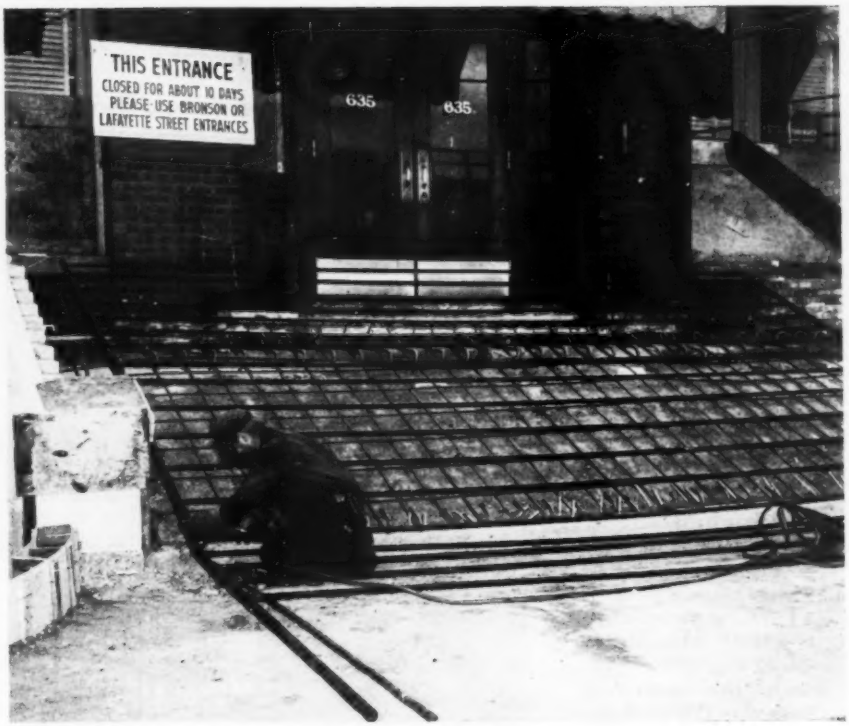
A somewhat larger, separate, air-conditioning unit, with a 30-hp compressor and 4500 cfm air capacity, serves the cafeteria of the plant. This unit takes air from the outside and exhausts it through the kitchen fans.

Laboratory Ventilation

Adequate ventilation of the laboratory wing of the building is assured through the use of two parallel fans, Fig. 8, which handle 46,000 cfm of outside air, enough to completely change the air in the laboratory rooms once every four minutes. Intake air is filtered and tempered before it is supplied through a duct system to each room. Exhaust air leaves the rooms through the fume hoods and a system of transite ducts and roof fans. Individual control of the ducts enables laboratory personnel to vary the amount of air passing through the hoods or to by-pass the hoods completely by manually adjusting two cross-connected manual dampers.

Chemical drain lines, made of lead, are used to carry waste materials from the laboratory. These lines run to the basement of the building, where they are connected to chemical stoneware lines which convey the waste to a neutralizing system. The effluent from the neutralizing system is then discharged through a test manhole to the city sewer system.

All piping for the laboratory service facilities, together with power distribution lines and ventilating ducts, is carried in the two-foot walls in the corridor. Laboratories are supplied with hot and cold city and distilled water, vacuum, illuminating gas, and high-pressure process steam. City water and vacuum lines are of copper tubing, while the distilled water system, including still, heater, and distribution lines, is all tin-lined copper.



Welding wrought-iron pipe into position for snow and ice removal at the Studebaker plant. Grid will be located just below the finished concrete surface with the usual reinforcing steel being placed at the bottom of the slab

STUDEBAKER ELIMINATES THE WINTER ICE HAZARD

THE STUDEBAKER COMPANY of South Bend, Indiana, is definitely thinking about winter as they install a new stairway to the entrance of their administration building. To eliminate snow and ice hazard conditions, which sometimes is a problem in South Bend, this company has installed a complete set of radiant wrought-iron grid panels. Each section is completely welded and will be encased in the concrete stairway.

Anti-freeze will be mixed with the circulated heated water so the freezing point will be reduced to approximately minus 40 F. The system will be entirely enclosed, and water temperature will be held at 100 F automatically by means of a thermostat located in the outlet of a steam heat exchanger. Steam flow will be regulated to hold the temperature constant as the water leaves the exchanger. The predetermined temperature at present is 100 F, but this is temporary and will be varied either up or down as the conditions may demand.

Circulation of heated fluid through the grid will be accomplished with a 1 in. ¼ hp pump. The grid is constructed so each circuit will offer the same resistance, thereby insuring a constant distribution of circulated water over the entire stairway area. The amount of fluid pumped per min has not as yet been determined.

An extensive experimental phase will be underway this winter to determine the optimum amount of heated water. When this volume of heated water has been found, the amount will be regulated by restricting the flow to the suction side of the pump. Plans call for the continuous circulation of water to the grid with modulated control on the steam to hold desired temperatures when set.

The stairway and landings will be reinforced with steel rods, as the wrought-iron grid will be located approximately 2 in. below the concrete finish. In the past, the grid network was utilized as a reinforcing mat, but effect, strength and heating capacity were reduced by centering this unit in the concrete mass. Here at Studebaker, the engineers decided to consider the strength value of the grid as negligible, and plans went ahead accordingly. Their conclusion was, effective heating could only be obtained with the water piping at a maximum depth of 2 in. With this in mind, normal reinforcing for the concrete slab was designed.

Spot News

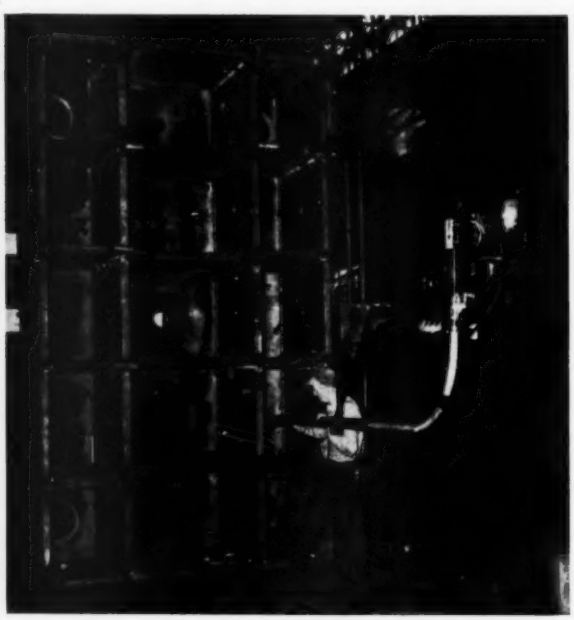
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Giant Press Base Welding Saved Three Months Delay

Recently the base of a 1,100-ton, Baldwin-Southwark press, used by the Henry Vogt Machine Co., Louisville, Kentucky, split in two while squaring the ends of sectional headers. This giant hydraulic press made it possible to forge sectional-header boilers for Victory ships.

Unfortunately when the base for a 1,100-ton press breaks, the prospect of lost production begins to loom ahead. Through their experience with the use of Unionmelt welding in the fabrication of boilers, heat transfer, oil refining and similar equipment, management at this Company decided to expedite the repair of the press using this process to fabricate a base in their own shop. Such a step would enable them to have the press in operation long before a replacement could be obtained. This was done and the press was back in operation 3 months earlier than it would have been had a casting been made.

Finished base is 13 ft long, 7 ft-7 in. wide, and 3 ft-10 in. high. Top plate is made of steel plate 5 in. thick. Bottom and side plates are made of 3 in. and 2½ in. thick steel respectively. All parts for this 10-ton box were oxygen-cut to size from firebox quality 70,000 psi tensile strength steel and welded into place with a Unionmelt UE-37 welding machine, thus shutdown time was minimized greatly.



Stud Welding Speeds Up Roof and Siding Construction

Stud welding, the high-speed, war-born technique, which saved ship-builders an estimated 100 million manhours in six years, enabled the contractor responsible for installing

18,000 squares of corrugated aluminum roofing and siding at Alcoa's new Point Comfort Works (INDUSTRY and POWER, July pp 84) to break all records on this job.

Working from swinging scaffolds with one Lincoln 300-amp welding generator for every four stud welding guns, 35,000 composite aluminum and mild steel studs were installed before the first sheet of corrugated material was applied. In this fashion, the stud welding quartets completed the installation of all the studs required for 500 squares of roofing in six days, while a double quartet handled the studding for 900 squares of siding in five days.

Speed with which the siding was applied resulted in the assignment of two stud welding gangs for every sheeting crew. In this way, a 7-man team—four stud welders and three sheeters—hit a steady stride of between 2500 and 4,000 sq ft of siding per day, while 8-man roofing teams—four stud welders and four sheeters—completed between 4,000 and 6,000 sq ft every day.

Supersonic Wind Tunnel Model Operated with Low Pressure Steam

Working model of a revolutionary type of supersonic wind tunnel, employing steam instead of compressed air, has been developed at Pratt Institute by senior mechanical engineering students under the direction of Major James R. Randolph of the engineering school faculty. Believed

to be the first application of steam to wind tunnel operation, this new modification makes possible the use of wind tunnels ten times the internal area of the largest supersonic tunnels now in use.

This new principle eliminates electric power plants and air compressor systems now necessary for operation of the largest supersonic wind tunnels. Economies in installation cost and making large tunnels practical for experiments on aircraft and missile designs under conditions of tremendous velocity are feasible.

The small, four-inch-square model at Pratt is connected to the Institute steam lines, which carry 115 psi, and is reduced to five psi. Raising the steam temperature in the throttling process produces a velocity in the tunnel of 1360 mph. A test specimen mounted in the tunnel is connected to strain gages, which measure the effect of the high speed gas stream exerted upon it.

Research Laboratory Dedicated to Promote Safety and Health

One of the world's largest research laboratories devoted to the development of safety equipment for all industries was dedicated in Pittsburgh by the Mine Safety Appliances Co. About 400 leaders in safety and industrial hygiene and health, as well as top industrial executives, attended the exercises. Principal speaker was Ned H. Dearborn, Chicago, president of the National Safety Council.

Facilities of the new laboratory will be used in developing equipment and devices to combat hazards of all types. Safety equipment and instruments for use in such relatively new fields as air pollution and atomic energy are among the projects planned in the laboratory. There also will be continuing research to improve existing safety devices and rescue apparatus. Virtually every branch of science and engineering is utilized at the laboratory for developing protective equipment and instruments.

The four-story laboratory building will contain many types of research instruments and equipment. This will include high altitude chambers; dust, fume and gas chambers; a wind tunnel, and an electron microscope that permits study of dusts and other substances at a magnification up to 100,000 times. A library will offer a comprehensive

collection of data that cover the fields of safety and industrial health and hygiene. An experimental shop on the ground floor manufactures new models of instruments and equipment developed through research.

Director of Mine Safety Appliances Company's Research

(Continued on page 133)

Basic Design

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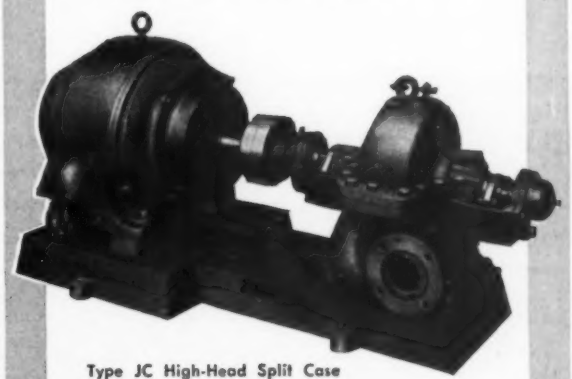
Unless your pumping installation incorporates the right basic design, you're pumping away money. The outstanding feature of WEINMAN Centrifugal pumps is the soundness of their basic design. WEINMAN engineered features make these pumps perform most efficiently . . . dependably . . . economically. The men responsible for these designs specialize in one product — Centrifugal pumps but their knowledge covers and benefits all industries, yours included.

You may be surprised to learn what the *right* basic design can do for your present pumping operations. A nearby WEINMAN representative can give you facts and figures. Contact him by mail, wire or phone TODAY!



Type JC High-Head Split Case Pump . . . two stage, back to back, impeller design . . . Capacity up to 600 G.P.M., Heads to 600 feet.

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MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

Corrosion Refresher Course—Nine lecture periods, with adequate time for discussions, have been scheduled tentatively at Cleveland, for the Case Institute of Technology corrosion course to be held Sept. 25 to 29, under direction of Dr. R. B. Hoxeng. The course is prepared as a refresher for those actively engaged in corrosion prevention, yet will not be too advanced for beginners.

The Case Institute course is the second such undertaking in which NACE has co-operated. Further information and application blanks are available from DR. R. B. Hoxeng, Case Institute of Technology, Cleveland 6, Ohio.

National Academy of Sciences—The National Academy of Sciences will hold its autumn meeting at the recently completed quarters of the General Electric Research Laboratory near Schenectady, N. Y. According to Dr. A. N. Richards, President of the Academy, the meeting will begin on Monday afternoon, Oct. 9.

Illuminating Engineering Society—The Illuminating Engineering Society will hold its national technical conference at the Hotel Huntington, Pasadena, Calif., August 21 to 24.

Eastern members can arrange to travel on the special conference train leaving Chicago Friday, Aug. 18, stopping to pick up other members at Kansas City, Wichita, Amarillo and Belen, New Mexico. The train will allow a one day stop at Grand Canyon. Registrations and reservations are being handled by IES headquarters at 51 Madison Ave., New York 10, N. Y.

National Safety Congress—The 38th National Safety Congress and Exposition will be held Oct. 16 to 20 in Chicago, Ill. Sessions on industrial safety are scheduled at the Stevens, Congress and Morrison Hotels, and traffic safety sessions at the Congress. For more details write R. L. Forney, general secretary, National Safety Council, 425 North Michigan Ave., Chicago 11, Ill.

Industrial Management Conference—A program of panels, displays, seminars and addresses by management leaders will feature the fourth annual University of Missouri Industrial Management Conference to be held at Columbia, Mo., November 2 to 4. The conference is sponsored by Associated Industries of Missouri, Society for Advancement of Management, Industrial Council of Kansas City and the Industrial Relations Club of St. Louis. Robert C. Manhart, professor of Business Management is chairman of the conference.

International Trade Fair—Products from more than forty nations will be exhibited at the first United States International Trade Fair to be held in Chicago, August 7 to 20. Exhibits will cover all industries including consumer goods, industrial supplies and equipment as well as raw materials, chemicals and metals. For more information write Nathan E. Jacobs, Director, Public Relations, Merchandise Mart, Chicago 54, Illinois.

National Power Exposition and ASME Meeting—The 19th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, November 27th to December 2nd under the auspices of the ASME in conjunction with the Society's annual meeting. The 1950 exposition will be the first to be held under the auspices of the ASME.

Complete information may be secured from Grand Central Palace, New York 17, N. Y. Charles F. Roth, president of International Exposition Company is manager of the exposition. E. K. Stevens is associate manager.

Instrument Society of America—Houston Section of the Instrument Society of America has announced that the Instrument Conference and National Exhibit will be held September 10-14 at the Coliseum in Houston, Texas. W. H. Fortney, Chairman of the Committee will handle arrangements. Mr. Fortney is the instrument foreman at the Humble Oil & Refining Company's Baytown refinery.

The following societies are cooperating in the Convention plans: The Industrial Instruments and Regulators Div. of ASME, American Institute of Physics, Instruments and Measurements Committee of the AIEE, Institute of Radio Engineers, National Telemetering Forum, and Scientific Apparatus Makers Association.

National Instrument Conference—Fifth National Instrument Conference and Exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18-22, 1950. It will include technical sessions of the following participating societies: The Instrument Society of America, American Institute of Physics, Industrial and Regulators Division of the ASME, Institute of Radio Engineers, Instruments and Measurements Committee of the AIEE, and National Telemetering Forum.

National Power Show—The 49th annual National Power Show sponsored by the National Association of Power Engineers will be held in Hotel Jefferson, St. Louis, Mo., August 15-19, 1950. It will run in conjunction with the 67th NAPE annual convention. John C. Toohy, 176 W. Adams St., Chicago, is exhibit manager.

BOOK REVIEWS . . . .

Here are the latest books from the publishers' lists reviewed for your convenience in selecting the ones that will meet your needs in a variety of engineering, plant equipment and related subjects

Cast Brass Standards

"Cast Brass Solder-Joint Fittings—B16. 18-1950." Published by American Standards Association, 70 East 45th Street, New York 17, N. Y. 75 cents.

This new standard replaces the American Standard Soldered-Joint Fittings (A40.3-1941) which had been developed for use primarily with plumbing equipment. The new edition recognizes the fact that this type fitting is now being used for general purposes other than plumbing. Drainage fittings are not covered, as a separate standard is being developed.

Pressure ratings; abbreviations for end connections; sizes and method of designating openings of reducing fittings; marking; minimum requirements for material; dimensions and tolerances; and tests are covered in detail.

Sponsors for the standard are the ASME; Heating, Piping, and Air Conditioning Contractors National Association; and the Manufacturers Standardization Society of the Valve and Fittings Industry.

Economic Development Atlas

"Economic Development Atlas—Recent Changes in Regions and States," prepared by Victor Roterus and Sterling March of ODC's Area Development Div. Available from the Superintendent of Documents, Washington 25, D. C. and local field offices of U. S. Department of Commerce. 75 cents.

Graphic presentation of how the economy of the United States, by states and regions, has changed in recent years has just been completed. This publication should prove extremely useful to business and industrial planning executives. The book contains fourteen schematic maps, each accompanied by brief narratives and tables. Maps depict the shares of national economic gains as they were distributed among the nine regions into which the country is divided and among the states. It covers such factors as population, manufacturing, agricultural operations, and total and per capita income.

Maps, texts, and tables are arranged to enable the user to determine the development status and trends of each state and region and to determine absolute gains and rates of increase on twelve specific points.

Sales Engineering

"Sales Engineering" (second edition) by Bernard Lester. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 226 pages, $3.00.

Art of selling equipment and services that require engineering skill in their selection, application, and use are brought out clearly in this book. Types of work this involves, opportunities it offers for a career, and methods such as skills and techniques are described.

The author not only covers actual sales methods but he also examines the sales engineer—his product, market, and training. Actual case histories are the basis for the illustrations, which back up the author's points and serve to (1) demonstrate the practical application of his suggestions and (2) make ideas stick in the reader's mind longer.

This book is written for the trained technical man to apply as a basic course in engineering selling. While some of the principles are basic for consumer and engineering products, a careful distinction is made between the two. Of particular importance is the stressing of selling through persuasion rather than through high-pressure tactics.

Lead Toxicology

"The Proceedings." Published by the Lead Industries Association, 420 Lexington Avenue, New York 17, N. Y. Illustrated. 137 pages, $1.00.

This book contains the Lead Industries Association's factual data on lead toxicology of its Lead Hygiene Conference held in Chicago, Ill. Among the conferees were outstanding authorities on industrial hygiene from industry, civic and educational groups, insurance companies and consultants.

Subjects covered are: The Co-ordination of Industrial Medical Services; Solubility and Particle Size in Lead Poisoning; Air Pollution Regulations in Los Angeles County; Aluminum and Silicosis; The Treatment of Lead Poisoning—Past and Present; Preventive Medical Armor for the Lead Industry; Medical Control of Lead Workers—A State View-point; The Production Manager Looks at Industrial Health; The Effect of BAL on Experimental Lead Poisoning; and Urinary Porphyrins in Lead Poisoning. A discussion period following each of the papers was led by an outstanding authority, and the discussions are included in the Proceedings. A summation of the conference is given by Anthony J. Lanza, M.D., formerly associate medical director, Metropolitan Life Insurance Co.

Titanium Alloys

"The Manufacture of Titanium Alloys—PB 100,000," prepared by P. R. Mallory Co. Published by the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C. Illustrated. 108 pages. Microfilm, $4.50, photostat, $13.75.

Details of extensive research on titanium alloys are now available to the public. The research report includes reference to the 5% chromium, 3% aluminum, titanium alloy recently described by the Navy as having the strength of high-strength steel with only about half its weight.

Among the tabulated results given in the report are the effects of the following constituents in titanium alloys: carbon; copper; manganese and silicon alone and in combination. Aluminum, chromium, and carbon are described as forming "strong, ductile, high electrical resistance alloys" with titanium. Alloys

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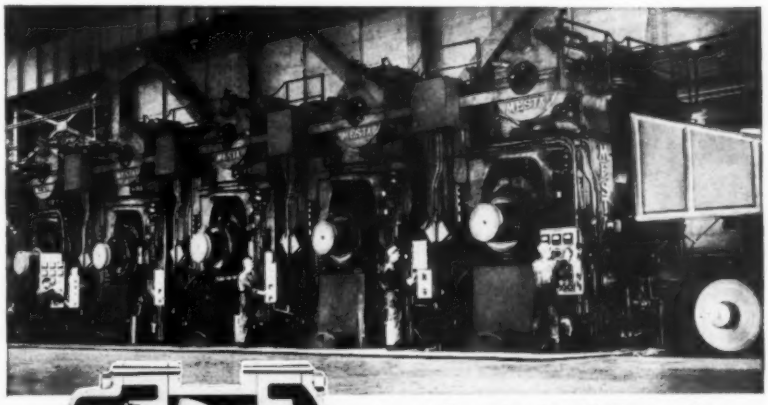

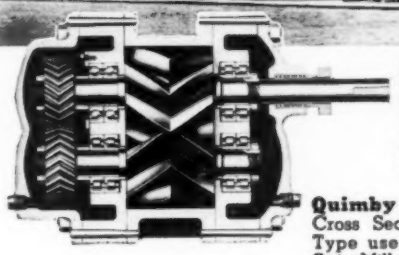

Pumping for this Pacemaker —Quimby Pumps lubricate this Mesta 42" five stand tandem cold mill, installed at the Aliquippa Works of the Jones and Laughlin Steel Corporation.

Quimby "Rotex" Pump— Cross Section of Gear-in-Head Type used in World's Fastest Strip Mill.

Fourteen Quimby "Rotex" and Screw Pumps perform the key jobs of lubricating this pacemaking strip mill. At seven vital points the reliability and efficiency of these Quimby Pumps assure smooth operation and help maintain the productive pace. Exceptionally rugged, they keep maintenance at a minimum.

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of either chromium and aluminum alone have little or no ductility but show improved hardness at elevated temperatures. The melting furnace, the preparation of charges, and the fabrication of ingots are described.

A-C Fundamentals

"Fundamentals of A-C Circuit Interruption," by Dr. Erwin Salzer. Published by Allis-Chalmers Mfg. Co., Industrial Press, Milwaukee 1, Wis. Illustrated 56 pages, bound. 40 cents.

This booklet is a concise presentation of circuit closing and opening operation. It has been compiled from a series of articles on "Fundamentals of AC Circuit Interruption" published in the Allis-Chalmers Electrical Review of 1948 and 1949 and is written on the level of a college text on physics. It emphasizes physics and physical reasoning. Especially applicable for plant engineers concerned with electrical distribution design.

Laboratory Procedure

"Radiological Laboratory." Published by New York University College of Engineering. Bureau of Public Information, New York 53, N. Y. Illustrated. 10 cents.

A new 4-page folder that treats atomic laboratory problems is now available that will be useful to laboratory technicians. It describes radioactive isotopes thoroughly. Hazards, special equipment required and how atomic wastes are handled are explained and illustrated. Data on design and operation of such a laboratory are given.

Material Handling

"Handbook of Material Handling." Published by Electrical Industrial Truck Association, 3701 N. Broad Street, Philadelphia 40, Pa. Illustrated. 72 pages. $1.00.

This handbook is a practical guide for the analysis of material handling operations and the application of the unit-load method with power-operated industrial trucks and accessories. It is entirely new in text, illustrations, charts and diagrams, together with engineering data and supplants the former Materials Handling Handbook. The former handbook ran through six editions and was regarded as the standard authority on material handling practices employing industrial trucks.

Divided into four sections, this new edition, contains: (1) The Evaluation of Industrial Truck Handling; (2) Material Handling Management, with subsections devoted to the preparation and use of flow process charts, handling operations in production, handling in storage, the use of unit loads in storage, with layouts and commodity and capacity factors (3) The Organization of an Industrial Truck System and (4) Practical Truck Engineering.

Steam Turbines

"Steam Turbines and Their Cycles" by Kenneth Salisbury. Published by John Wiley & Sons, Inc. 440 Fourth Avenue, New York 16, N. Y. Illustrated. 645 pages. $9.00.

This book contains short-cut data never published before and emphasizes in thoroughly digestible terms (devoid of abstract and unnecessary theory), the essentials of design of steam turbines. It presents design and performance data, which have not been previously published. Also included are both "basic principles," and the most advanced thinking on new methods of analysis in this field. Extensive use has been made of actual examples taken from practice.

Important features are: (1) complete coverage of material from basic principles to the most advanced thinking in the field, (2) special short-cut methods emphasized, (3) absence of "deep" theory—any engineer or engineering student can understand it, (4) extensive practical design methods, design charts and curves, (5) valuable test data analysis, (6) extensive use of examples taken from practice, (7) problems at the ends of chapters to assist in driving home the principles set forth, and (8) a money-saver for engineers—by making possible intelligent appraisal of the economics of alternative plant designs.

The book is divided in four parts as follows: Fundamentals of Turbine Design, The Regenerative Cycle, Cycle Analysis and Application Engineering.

Engineering Speech

"Speaking Can Be Easy." Prepared by the committee on Relations with Industry of the American Society for Engineering Education. Available from Engineer's Council for Professional Development, 29 West 39th Street, New York 18, N. Y. 50 cents.

This practical pocket size booklet started over three years ago is a concise manual to help engineers become better speakers and hold better meetings. It can be read through in 30 min. Illustrations in a humorous vein appear on each spread to emphasize the major points. Effective organizing of the text enables the reader to cover the most important points easily. Check lists for speaker and the meeting chairman provide help for the improved execution of their respective responsibilities.

In "The Speaker" section the following subjects will be found of particular value: what type of speech, planning and preparing, attention patterns, platform manners and microphone technique.

Of special interest to the chairman is "The Meeting" section with its treatment of effective introductions, starting and handling questions and assuring bigger and better audiences.

"How Can I Improve," and "Background for Better Speaking" include 12 carefully selected references for further help on the various phases of speech psychology and effective speaking.

NEMA Standards

"NEMA Standards for Varnished Tubing and Saturated Sleeving." NEMA Headquarters, 155 E. 44th Street, New York 17, N. Y. 50 cents.

This NEMA standard will give aid on the proper selection and purchase of flexible tubular products for electrical insulation purposes. Varnished tubing and sleeving is braided from nylon, glass, rayon, cotton or other fibers and then treated with electrical insulating materials. According to the manufacturers, this results in a flexible tubular dielectric tubing or sleeving, which is eminently satisfactory. It is widely used for insulating wires on electrical apparatus and appliances, such as motors, transformers, radios, television, fans, controls and instruments.

Standards contain information on the classes, grades, color, appearance, length, tolerance on cut pieces, inside diameters and measurement of flexible varnished tubing and saturated sleeving. An entire section is devoted to sampling, conditioning of specimens and to the following tests: dielectric, heat aging, transformer oil, heat endurance and burning. A table gives identification of grades and a summary of performance characteristics.

Welding Reference

"Holdings in the A. F. Davis Welding Library," Engineering Experiment Station Circular 51. Compiled and published by the Department of Welding Engineering, Ohio State University. 50 cents. Also "Patent Classifications in the A. F. Davis Welding Library," Engineering Experiment Station Bulletin 140. 75 cents.

"Holdings in the A. F. Davis Welding Library" is made in answer to many requests to the University for information on published works in the welding field and those fields contributing to the science and art of welding. This list of titles is not meant to be a complete bibliography of the field but is published to assist corporations, individuals, and other libraries in using the Davis Library or in building their own collection.

"Patent Classification in the A. F. Davis Welding Library" gives the outline of the patent classification index and explains in detail the operation and use of the system. The bulletin is designed to assist off campus users.

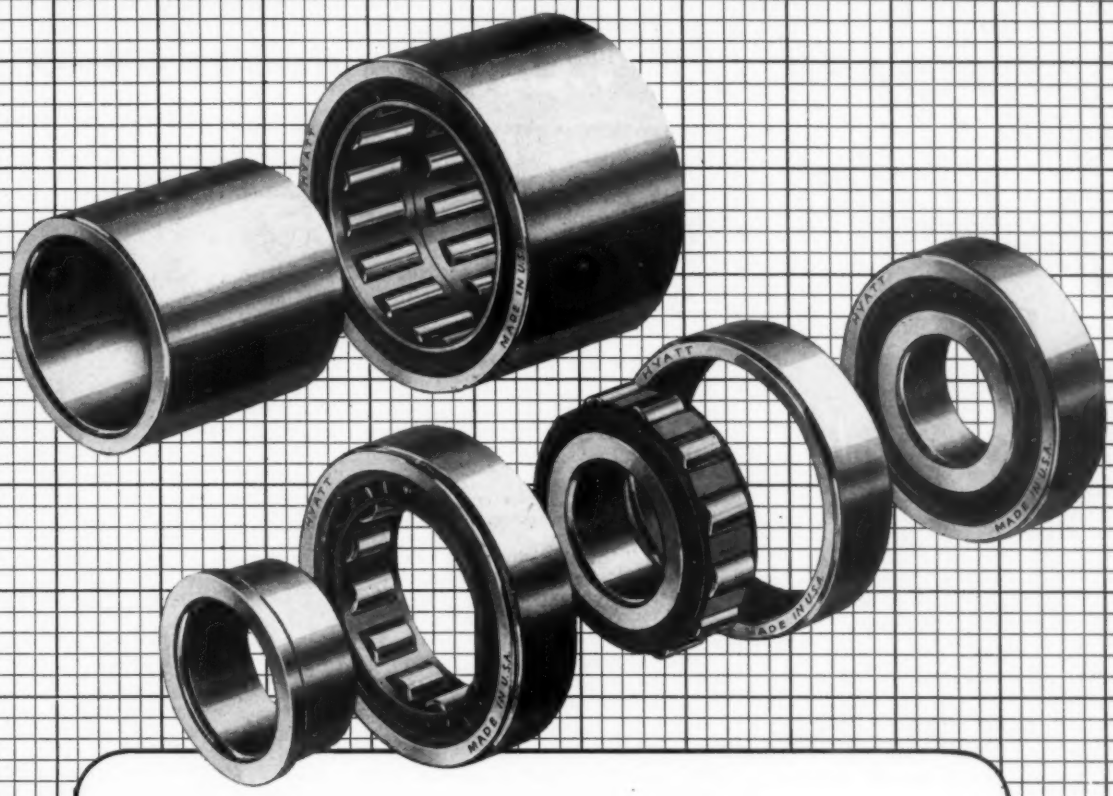
The Davis Library has maintained, for a number of years, a collection of patents relating to the welding industry. The patent classification system described in Bulletin 140 is an effort to make this collection of greater value to students and industry. The primary purpose of this project has been to provide, efficiently and on a wide scale, information on welding patents to industrial organizations and educational institutions. This classification aims to provide references not only to the fundamental patents on welding processes, materials, and equipment, but also to the patents on the industrial applications of welding.

Illumination Practice

"Recommended Practice of Daylighting." Prepared and published by Illuminating Engineering Society, 51 Madison Avenue, New York 10, N. Y. 36 pages. Illustrated. 50 cents.

Daylighting practice, first ever published by IES on this subject, discusses in detail prescribed means for the utilization of daylight in building design.

Introductory section describes design principles for windows, shows illumination distribution in rooms, includes tables of solar position in various latitudes. Report recommends window arrangement; control media, such as louvers, blinds and glass block; treatment of reflecting surfaces of work areas in schools, factories, offices and homes. The new practice defines terms used and sets up criteria for good lighting.



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NEWS . . . of men and companies

Westinghouse Electric Supply Co.—On July 1, John F. Myers became president of this subsidiary of Westinghouse Electric Corp. succeeding David M. Salsbury who became vice president in charge of Texas & Pacific Coast operations.

American Chain & Cable Co., Inc.—Charles L. Haslup, well-known in the valve industry for many years, was recently appointed sales manager of the R-P&C Valve Div. with headquarters at Reading, Pa.

International Harvester Company—L. J. Lange has been appointed industrial power product specialist. His duties will be concerned with the design and sale of industrial wheel and crawler tractors and power units. Mr. Lange succeeds S. L. Siegfried.

The Swartwout Co.—The appointment of Industrial Sales & Engineering Co., Memphis, Tennessee, as sales representatives for the area has been made. C. W. Dean and R. E. Overman, well known in the power plant field, will supervise sales of power plant equipment.

Also appointed at the same time was the Albuquerque Engineering Co. in Albuquerque, N. M., as power plant equipment representatives. C. E. Barnhart of Albuquerque Engineering Co., which also handles industrial ventilating equipment, will be in charge of steam specialties sales.

Quaker Rubber Corp.—After 48 years of continuous service with this division of H. K. Porter Co., Inc., Frank L. Jones, secretary and assistant treasurer, retired June 1.

Dearborn Chemical Co.—Appointment of J. F. Lingeman as manager of purchases and production was announced at a recent board of directors meeting.

Dodge Manufacturing Corp.—Kenneth Bassett was appointed supervisor of sales promotion. Mr. Bassett has been associated with Dodge 23 years.

The American Smelting and Refining Co.—Reorganization of its sales and distribution plans for continuous-cast products of brass and bronze was announced.

John L. Kimberley has been named sales manager and will direct the new program from the Perth Amboy Plant. Ralph W. Bailey and John V. Hackett have been appointed assistant sales managers.

Donald S. Goebel, who handled the Asarco continuous-cast alloys when they were distributed by Ampco Metal, Inc., has joined the company and will make his headquarters at the Whiting, Ind., plant.

Company representatives will handle the sales for 37 states in the eastern, midwestern, south and southwestern areas, with the western area being handled by Kingwell Bros., Ltd. of San Francisco.

Kurz and Root Co.—Eugene B. Brownell, is now president and general manager of this company. Henry

Cooper-Bessemer Corp.—Hewitt A. Gehres, executive vice president and director of engineering, was recently bestowed the Honorary Degree of Doctor of Science by the Grove City College, Grove City, Penn. In presenting the degree, Dr. Weir C. Ketler, Grove City College president, congratulated Mr. Gehres on his many important accomplishments and on the high position he has attained in the engine-building industry during his long and continuing engineering career.

In addition to his engineering work with Cooper-Bessemer, Mr. Gehres has written numerous engineering papers and holds active membership in ASME, The Society of Naval Architects and Marine Engineers, and The American Petroleum Institute.

Kuhn, former president, becomes chairman of the board and he will supervise engineering and technical departments.

Plomb Tool Co.—Frank O. Maxwell and A. Calder Mackay have been elected to the board of directors. J. G. Allen has been appointed a vice president.

Mr. Maxwell fills the vacancy on the board created by the recent death of

F. O. Maxwell

A. C. Mackay

Oliver B. Scott; Mr. Mackay succeeds James L. Beebe, who resigned from the board of directors because of ill health.

Mr. Allen, who has managed the company's export department for more than 3 years, was made vice president in charge of export sales.

Northern Equipment Co.—E. W. Nick, formerly president of this division of Continental Foundry & Machine Co. has been elected chairman of the board. George L. Davis replaces Mr. Nick as president of the Northern Equipment Co.

American Society of Tool Engineers—A. James Leone, chairman of the Boston chapter of ASTE recently was elected to the executive board of the Engineering Societies of New England.

Topflight Tape Co.—This company, which developed and perfected printed, pressure-sensitive tapes during the late war, started operation in an old mansion of the 90's era.

Since then, Topflight has spread to four other locations, widely scattered. As of June 1st, 1950, all of the administrative, sales, order, accounting and advertising departments will be located in one building at 116 East Market St. in York, Pa.

BullDog Electric Prods. Co.—Leo P. Lipscomb, formerly midwest div. manager, has been appointed sales manager. Merle P. Spurrell succeeds Mr. Lipscomb as midwest div. manager.

Cornell University—Prof. Harry J. Loberg was appointed director of Sibley School of Mechanical Engineering at Cornell University on July 1. A member of the Cornell faculty since 1934, Professor Loberg became acting director last year following the resignation of Prof. W. Julian King.

Tube Turns, Inc.—Thomas Robertson & Co., Ltd., of Montreal, has been appointed a distributor of Tube-Turn welding fittings and flanges. The company will represent both Tube Turns, Inc., and Tube Turns of Canada Ltd.

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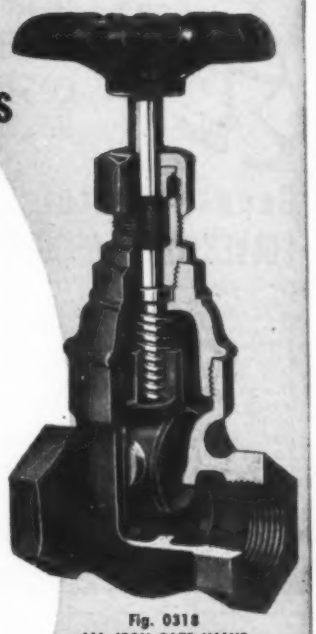

Fig. 0318
ALL IRON GATE VALVE
150# SWP 225# WOG
Non-Rising Stem • Solid Wedge • Taper Seat
½"-2" Sizes

Fig. 0904
ALL IRON GATE VALVE
125# SWP 200# WOG
Solid Wedge • Taper Seat • Malleable Iron Seat Rings
2"-12" Sizes

Fig. 0418
IRON BODY U-BOLT GATE VALVE
150# SWP 225# WOG
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½"-4" Sizes

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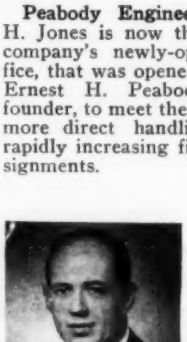
E. F. Drew & Co., Inc.—Thomas S. Agramonte, manufacturers' agent with offices at the Pan American Airways Building, Cale 23 #105, Havana, has been appointed representative for the Power Chemicals Div. in Cuba. He will represent the Drew Co. in the sale of their evaporator and boiler water treatment.

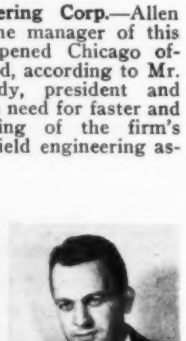
The National Supply Co.—W. T. Cushing, Jr. has been appointed manager, drilling equipment sales, succeeding W. R. Ryburn, just appointed manager of seamless products sales for the Spang-Chalfant Div.

Allis-Chalmers Mfg. Co.—Russel C. Orton and Royce B. Crimmin, who recently completed Allis-Chalmers' graduate training course, have been assigned to the Boston district office as sales representatives.

Peabody Engineering Corp.—Allen H. Jones is now the manager of this company's newly-opened Chicago office, that was opened, according to Mr. Ernest H. Peabody, president and founder, to meet the need for faster and more direct handling of the firm's rapidly increasing field engineering assignments.



A. H. Jones



J. C. Chase

The Marley Co., Inc.—Jim C. Chase has been named manager of the recently expanded DriCooler sales department. He has been located at the general offices in Kansas City, Kan. since joining the company late in 1948.

Robins Conveyors Div.—The Cleveland office of the Robins Conveyors Div., Hewitt-Robins Inc., has moved from 215 Rockefeller Bldg. to 8905 Lake Ave.

Westinghouse Electric Corp.—Because of the increasing industrial importance of the South—and especially the Birmingham region this company will build a new plant at that location. The new unit will be operated by the Manufacturing and Repair Department and will provide extensive overhaul and repair facilities to serve customers in all parts of Alabama.

Joseph H. Cox has been named supervisor of electrical engineering for the Sunnyvale Works at Sunnyvale, California. In addition to his new duties, Mr. Cox will retain district-wide supervision of quality control in the company's western plants.

Chiksan Co.—Appointment of two new representatives has been announced by G. R. Winder, vice president and sales manager. Robert S. Hudgins, Jr., Charlotte, N. C., will cover North and South Carolina. The Southern Corp., Charleston, S. C., will continue to represent Chiksan in the pulp and paper industry in these states. R. S. Stover Co., Marshalltown, Iowa, has been appointed to cover Iowa and Nebraska.

Chain Belt Co.—Marshall E. Cusic has been appointed district sales engineer with headquarters at the Pittsburgh district office.

Mr. Cusic, a graduate of Purdue Univ. with a degree in ME, joined the company in 1937. After completing a comprehensive training program, he was assigned to the methods and standards department of the Rex Chain and Transmission Div.

Hewitt-Robins Inc.—Hewitt Rubber Div., manufacturers of industrial rubber products and bulk materials handling equipment, announces the appointment of three new distributors. The Tuller Equipment Co., Columbus, Ohio, is to be the exclusive distributor in the southwestern third of Ohio for gasoline market rubber products. The Reliance Equipment & Supply Co. of Roanoke, Va., is the new distributor for general mill supply products in that area and John Conlon in the Glens Falls, N. Y. area.

Weston Electrical Instrument Corp.—The Tagliabue Instruments Div. has

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Reversible Ratchet STOCKS and Adjustable DIES

Exceptionally convenient where space is limited, this stock simplifies pipe threading close to walls, in corners and wherever operating room is restricted. With *adjustable* dies (cut exact, over or under size threads) it is an ideal tool where valves and fittings are being installed or maintained.

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nounced the appointment of the following Weston district sales representatives who are now, in addition, handling the Tag line: C. L. Huffman, Russell F. Clark Co., Pittsburgh; C. W. Stafford, the C. B. Fall Co., Saint Louis; E. F. Schimbor, Herman E. Held, San Francisco; R. C. Staub, the Beedle Equipment Co., Cincinnati; G. O. Miller, Schiefer Electric Co., Inc., Syracuse; T. J. Cunerty, Powerlite Devices, Ltd., Toronto; A. R. Hough Co., Knoxville; Edward S. Sievers, Los Angeles; T. S. Cawthorne Co., Detroit; Eicher & Co., Seattle; Ward Engineering Co., Inc., Orlando and Jacksonville; W. J. Keller, New Orleans; and, W. H. Dittman, Cowperthwait & Brodhead, Boston.

In the Colorado territory, the Peterson Co. and Burson Sales, Inc., of Denver, are representatives.

Weston Electrical Instrument Corp.—Edward F. Weston, chairman of the board of directors, on June 1 marked the 50th anniversary of his association with the Weston company. The occasion closely follows the 100th anniversary of the birth of his father, Dr. Edward Weston, who founded the company in 1888.

Mr. Weston participates actively in the management of the company in addition to being a director or member of many state and national organizations.

Acheson Colloids Corp.—M. W. Reynolds, vice president, announces that Melvin L. Bunting has been appointed a technical service engineer. He assumes his new position after service with the U. S. Gypsum Co. and with the Combined Metals Reduction Co. A chemical engineering graduate of the Michigan College of Mining and Technology, his functions will include engineering assistance to customers and new applications research.

The Goodyear Tire & Rubber Co.—A series of promotions and transfers effecting development personnel in plants at Los Angeles, Topeka, and Akron, are announced by Dr. R. P. Dinsmore, vice president in charge of research and development.

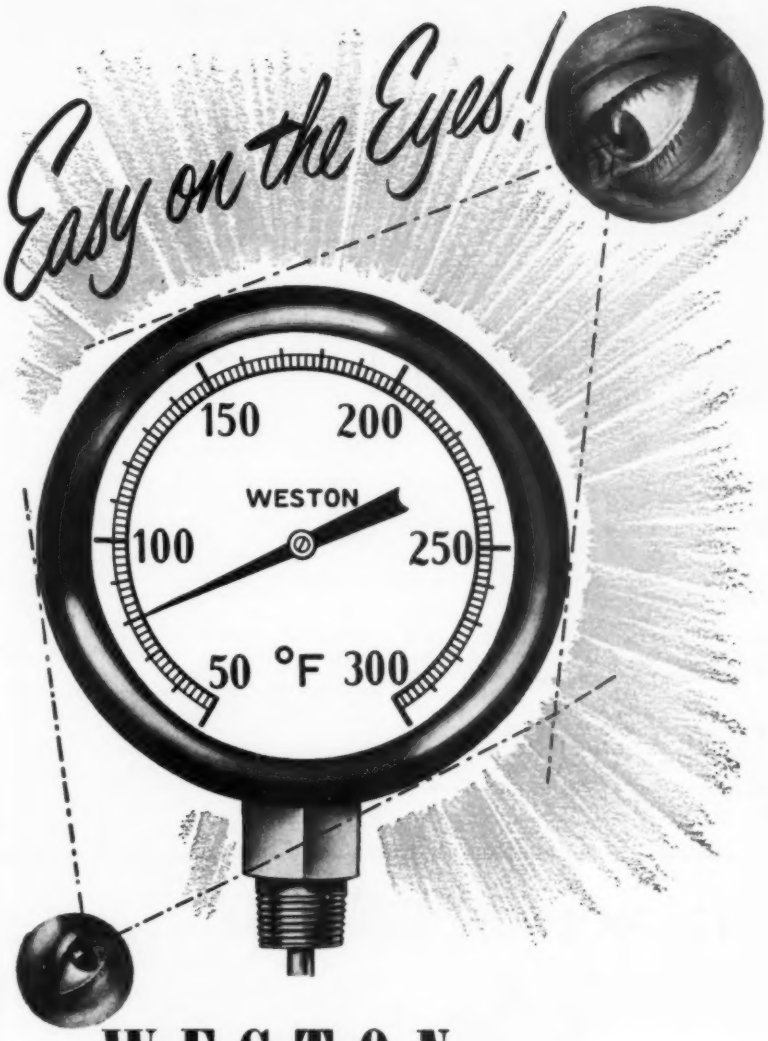
Phillip W. Drew, technical superintendent at the Los Angeles plant, has been recalled to Akron for a new and important assignment.

His successor, reporting for duty on August 1, is C. R. Washburn, now technical superintendent at Topeka, Kan. Moving into the vacancy created by Mr. Washburn's transfer, is L. H. Bennett, now chief chemist at Topeka.

L. D. Treleaven, a development compounder at Akron, was shifted to Topeka on June 15 to take over the chief chemist duties there.

Robert W. Maney, in charge of tire production at Plant 2 in Akron, Ohio, has been named plant manager of the company's plant in Los Angeles. He succeeds Frank A. Steele, who is retiring on September 1, after 40 years of continuous service.

Food Machinery and Chemical Corp.—Announcement of the appointment of Gene D. Sickert as works manager of the Indianapolis plant of the Peerless Pump Div., is made by G. F. Twist, general manager of the corporation's



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All-Metal THERMOMETERS

Easy on the eyes—that's just one feature that makes easy-to-read Weston Thermometers the answer to your temperature measuring problem.

Easy on the mind—you can relax when Weston All-Metal Thermometers are supervising important industrial processes.

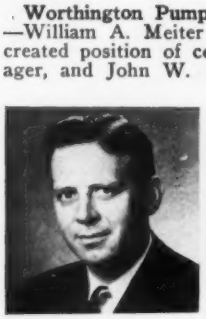
Easy on the budget, too—Weston All-Metal Thermometers deliver dependable, faithful service . . . year in, year out.

Be sure to check your Weston Representative—or write Weston Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue instruments.

WESTON *Instruments*

Pump Div. Sickert comes to Peerless from the Bolens Product Div., where he has held a similar position for the last four years.

Worthington Pump & Mach. Corp. —William A. Meiter fills the newly created position of central sales manager, and John W. Stovall succeeds



W. A Meiter

J. W. Stovall

Mr. Meiter as manager of the Buffalo district sales office according to an announcement by T. J. Kehane, general sales manager.

General Electric Co. — Dr. Lewi Tonks, physicist in the research laboratory, has been appointed head of the physics div. in the Knolls Atomic Power Laboratory, which GE operates for the Atomic Energy Commission.

W. Scott Hill, formerly vice president, engineering, of Locke Inc. at Baltimore, Md., has joined GE's apparatus department as manager, Commercial Engineering Div., of the Transformer and Allied Product Div. at Pittsfield, Mass.

A. K. Bushman has been appointed manager of Industry Div. in the sales organization of the Apparatus Department, according to Chester H. Lang, GE vice president in charge of sales for the department.

The newly-established position will be headquartered in Schenectady, Lang said. Bushman formerly was manager of the application and service engineering div.

Horace Zimmer, New York district manager for the Apparatus Department, has been appointed manager of districts, according to a recent announcement by Chester H. Lang, GE vice president in charge of sales.

He will be succeeded as New York district manager by Frank A. Faron, who has been the New York district's Industrial Div. manager.

Owens-Illinois Glass Co.—The Kaylo Div. has announced the transfer of its Dallas branch to Houston and the appointment of J. K. Dixon as sales engineer for the Houston territory, according to W. M. Hankins, Jr., div. general sales manager.

Mr. Dixon's territory will include the Gulf Coast east to Florida, the entire state of Louisiana, and Texas as far north as Waco and San Angelo.

Establishment of the Houston and Oklahoma City (plans under way) offices will widen the territory formerly covered by the Dallas branch. Coverage will be more complete and customer service will be increased.

T. F. Sears, former Dallas branch sales engineer, has been promoted to the general office in Toledo, Ohio, as supervisor of roof tile sales.

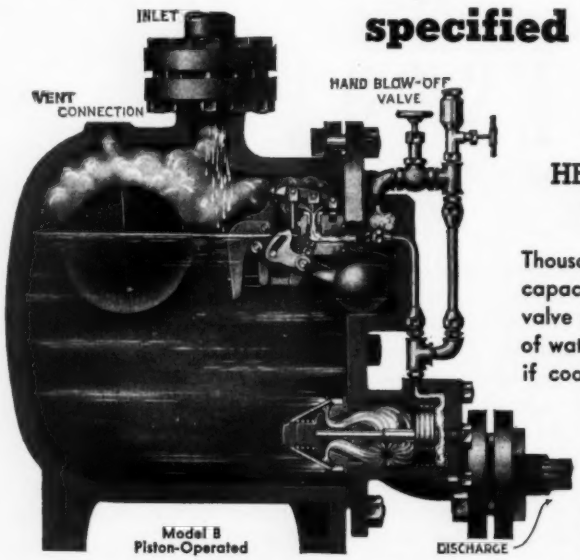
J. K. Dixon, new Houston sales engineer, joined Owens-Illinois in February of this year. Previously he had been affiliated with the Foster-Wheeler Co., Abercrombie Oil Co., and J. F. Pritchard Co. in project and design engineering capacities.

Chain Belt Co.—The following distributors have been appointed for products of the Chain and Transmission, Baldwin-Duckworth and Process Equipment divisions: Bush-Brehner, Inc., York, Pa.; Union Supply Co., Denver; Green's Hardware and Machinery Co., Crowley, La.; Guntert & Zimmerman Sales Div., Inc., Stockton, Calif.; Hopper Machine Works, Bakersfield, Calif.; Klamath Machinery Co., Klamath Falls, Ore.; Stacey Supply Co., Springfield, Mass.; Precision Gear & Machine Co., Charlotte, N. C.; and Transmission Supplies, Inc., Greensboro, N. C.

United Iron Works—V. Lobanoff has been appointed chief engineer for United Centrifugal Pumps Div., according to an announcement by the company's Oakland, Calif., offices.

During recent years, Mr. Lobanoff has been credited with major responsibility for development of a number of new pump designs, and a program to affect maximum interchangeability of parts in each line. In his new post, he will continue to direct new design development.

NICHOLSON "*Super*"... most widely specified trap for power plants

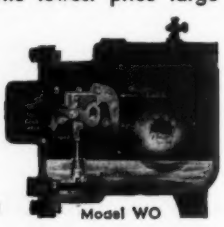


Especially Recommended for

STEAM PURIFIERS, HEADERS, SEPARATORS, HEATERS, SUPERHEATED STEAM LINES

Thousands of installations attest to the enormous drainage capacity of this Nicholson trap. Piston-operated and with valve orifices up to 2" diam., it discharges large volumes of water almost instantly. Other features: won't leak even if cooked dry; rugged; working parts of stainless steel. Pressures, 2 to 650 lbs. The lowest price large capacity trap.

NICHOLSON WEIGHT-OPERATED TRAPS — Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.



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135 OREGON ST., WILKES-BARRE, PA.

Catalog 250 or see Sweet's

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

OBITUARIES

Combustion Engineering-Superheater, Inc.—Terrell H. Walker, manager of the service and erection department, died at Roosevelt Hospital, New York, on June 9, after an extended illness. He was sixty-five years old and was widely known in the engineering field as an expert on the installation, starting up, and operation of power plant equipment.

T. H. Walker

H. E. Hollberg

%Proportioneers, Inc. %—Herbert E. Hollberg, vice president passed away at his home in Cranston, R. I. on July 1. At the time of his death, Hollberg was 51 years of age and was in charge of the sanitary engineering division of the company.

Weinman Pump Manufacturing Co.—William Nelson Weinman, 82, president and founder, died after a long illness. Much of his business career was spent in the developing and manufacturing of centrifugal pumps for all types of industrial use.

Whiting Corp.—Gen. Thomas Stevens Hammond, 66, chairman of the board, passed away at Chicago, Ill. on June 15.

Worthington Pump & Machinery Corp.—Wilbur H. Stacy, comptroller at Harrison Works died June 23, after a long illness.

Hercules Powder Co.—Lloyd Kitchel, a member of the board of directors and general manager of the Virginia Cellulose Department, died June 30 of a cerebral hemorrhage. His entire career was devoted to the development and expansion of cellulose.

Blatz Brewing Co.—Hal S. Johnson, 66, retired advertising manager died at Milwaukee, Wis., July 4, after a long illness.

E. F. Houghton & Co.—The death of George W. Pressell, 62, vice president occurred suddenly on June 5 at Ocean City, N. J.

General Motors Corp.—Mr. H. O. K. Meister, 62, general manager of the Hyatt Bearings Div. in Harrison, N. J. died June 10, at Shelter Island, N. Y.

Dept. of The Interior—Charles B. Carpenter, 49, supervising engineer for the Dallas, Tex., petroleum field office of the Bureau of Mines, U. S. Department of the Interior, died suddenly on June 10 at Dallas.

THIS TOOL
is rolling up
all-time
sales
records
Never in our history has any group of tube expanders enjoyed such popularity as the AIRETOOL ball-bearing types. Ever since their introduction, they have broken one sales record after another. Why?

- Designed RIGHT for fast, uniform rolling of condenser tubes.
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There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

Get Automatic CONTROL and SHUT-OFF of Air-Gases Liquids • Solids

ROCKWELL BUTTERFLY VALVES

Boost Operating Efficiency

To meet the growing demand for automatic valves for control and quick shut-off of air, gas, liquids and semi-solids, Rockwell Butterfly Valves are available in sizes from 1" to 84" pipe size, with construction to withstand almost any chemical or physical action, or temperature.

Such valves may be equipped with such mechanisms as electric motor; Limitorque control with push button stations and indicating lights to show full open and full closed position of the valve blade; air diaphragm operator, solenoid operator, hydraulic or pneumatic cylinder with or without limit switch, etc. Auxiliary hand wheel or lever controls can be applied for emergency manual operation.

Boost the efficiency of your plant or equipment with Rockwell Valves. Ask for our catalog.

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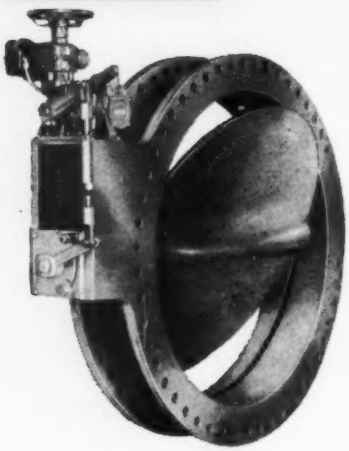

60" butterfly valve with motor operator and remote control, and auxiliary hand wheel control.

NEW BULLETINS

(Continued from page 24)

5000 psi and temperatures to 900 F. Advantages and applications for the ingenious constructions are given. United Centrifugal Pumps, Div. of United Iron Works.

Rotary Pumps (3C). Bulletin (8 pages) titled "Facts" illustrates design, construction, maintenance, operation and application of rotary pumps. Details of sliding and swinging vane types with selection table for specifying and other data of interest to engineers, maintenance men and plant operators included. Blackmer Pump Co.

Vacuum Pumps (3D). Cycloidal pumps, capable of producing vacuums of from 4 to 26 in. Hg in large capacities are described in 12-page bulletin. Application illustrations, cross-sections of pumps, installation diagrams and operating curves are included. Roots-Connersville Blower Corp.

TOOLS AND SPECIALTIES

Hard-Facing Manual (3E). New 40-page booklet tells the complete story of hard-facing. It explains how to select the right alloy and what welding process to use. Gives simple step-by-step instructions for applying the various rods by both the oxy-acetylene and metallic-arc welding processes. Haynes Stellite Div. Union Carbide & Carbon Corp.

Marking Stamps (3F). Steel stamps for all types of industrial marking applications are described and illustrated in new 4-page bulletin. Heavy or light duty hand stamps for applying straight or curved, and concave or covex markings are included as are dimensions, character sizes and prices. M. E. Cunningham Co.

Tube Bender (3G). Catalog sheet describes pipe, bar and angle-iron bender with new hydraulic attachment. Capacity 2 in. pipe. Hossfeld Mfg. Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

VALVES, PIPING AND FITTINGS

Fittings (3H). Bulletin describes a complete line of cast-iron, malleable and bronze fittings. Covers recent additions of cast-iron, screwed, flanged, sprinkler and extra-heavy malleable parts. The Kennedy Valve Mfg. Co.

Flexible Rubber Pipe (3J). Applications and comparative qualities of flexible rubber pipe are explained in 8-page bulletin. Economies in costs of installation and maintenance as well as longer life are explored in detail, along with typical case histories and recommended applications. The Hewitt Rubber Div., Hewitt-Robins, Inc.

Hose Fittings (3K). Hose couplings and fittings of various types for handling liquids and gases are described and illustrated in 12-page catalog section. It also gives details on each type, together with specifications, general and maximum pressure recommendations with a description of threads. The B. F. Goodrich Co.

Strainers (3L). Strainers with screens and perforated metal elements are described in recently enlarged 6-page bulletin. Specifications for steam, liquids or gas, with illustrations, are included. Yarnall-Waring Co.

Liquid-Level Gage Valve (3M). Four loose-leaf sheets give technical data, construction, and installation instructions with diagrams on valves for liquid-level gages. Jerguson Gage & Valve Co.

Non-Return Valves (3N). Technical descriptions, engineering diagrams of body and yoke patterns, parts list and operation and installation instructions are included in 8-page bulletin on triple-acting non-return and check valves. Golden-Anderson Valve Specialty Co.

Diaphragm Valves (3P). Flow control of corrosive and hard-to-handle liquids by means of diaphragm valves is discussed in 4-page bulletin. Cross-section drawings show construction and operation of the valves. Three tables chart availability as to size, type and material for most applications. Hills-McCanna Co.

Pipe Price Card (3Q). New data card designed to help in purchasing carbon-steel pipe or estimating cost of apparatus using this material is available. Card tabulates the present day prices, per hundred feet, of seamless carbon-steel pipe 1½ in. nominal dia and smaller; also for standard weight, extra-weight and double-extra-weight pipe. Babcock & Wilcox Tube Co.

Valve Positioner (3R). Description of the apparatus and how it functions to overcome stuffing box friction to maintain valve-plug position proportional to output pressure are contained in 8-page bulletin. Mason-Neilan Regulator Co.

Air Eliminator (3S). Two-page bulletin describes an automatic air eliminator for steam lines at pressures up to 150 psi. Gorton Heating Corp.

Piping Products (3T). In addition to data on a line of welding fittings, a 66-page technical reference section for engineers of welded piping systems is contained in this 184-page hard-cover book. There are charts, tables, graphs, of every description; welding data, design formulas, metallurgical information; also digests of more than 20 ASA and ASTM specifications covering pipe, fittings and flanges, with a discussion of code requirements for pressure piping and many other such subjects.

Midwest Piping & Supply Co., Inc.

HEATING, VENTILATING AND AIR-CONDITIONING

Radiant Glass Panels (3U). Glass panels with electrically conducting coating fired on the surface, typical applications and engineering properties of these radiant heating panels are presented in illustrated 8-page bulletin. It also contains sizes, rating table and price list. Corning Glass Works.

Air Heaters (3V). Illustrated 4-page bulletin describes applications of direct gas fired air heater for heating operations to 600 F. Discussion on construction features and safety controls are presented along with dimensional drawings for various models. Gehnrich Oven Div., W. S. Rockwell Co.

Blowers (3W.) Informative 2-page bulletin on blowers gives dimensional information including engineering layout, application and design data, blower number, rating—cfm at listed rpm—and other facts. Standard Stoker Co.

Dust Collectors (3X). How to cut maintenance costs with efficient, automatic self-cleaning, collecting system is the subject of 4-page bulletin. Also contains general data and dimensions of the unit. Turner and Haws Engineering Co., Inc.

Filters (3Y). Descriptive and illustrative literature on new dry panel filters gives 8 pages of informative data such as: performance data and resistance curves, selection and installation charts, and table of sizes and shipping weights. Features also are discussed. Dollinger Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

MISCELLANEOUS

Polyester Resins (3Z). Complete data on solutions of polyester resins in styrene are presented in a new 24-page booklet. Also contains tables and charts that define the properties of different types; recommends techniques for blending, laminating, compounding and curing; discusses the use of fillers, pigments and dyes in addition to suggestions for application. Rohm & Haas Co. Resinous Prods. Div.

Nickel Alloys (4A). Completely revised so as to be essentially new are two technical bulletins on the properties of high nickel alloys. 24-page publications are complete with illustrations, tables and graphs. They describe the engineering properties of Inconel, Incone "X", "K" Monel and "KR" Monel. The International Nickel Co., Inc.

Corrosion Prevention (4B). Metallized zinc or aluminum protective coat-

$300.00
OF RAW MATERIAL
IS RECOVERED EACH DAY

with DRACCO DUST CONTROL

There are 8 ways that DRACCO Dust Control increases plant efficiency and saves money. DRACCO Dust Control not only recovered $300.00 worth of raw material daily, but it also greatly reduced the cost of equipment maintenance. The savings, in reduced cost of maintenance, were enough in one year to pay one-half the entire cost of DRACCO Dust Control. This installation also saved money in SEVERAL other ways. Dust ALWAYS costs money. DRACCO Dust Control ALWAYS saves money. Why not consult DRACCO Engineers? They will analyze your dust problem and tell you what DRACCO Dust Control will save you.

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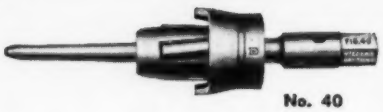
TUBE EXPANDERS NATIONALLY KNOWN FOR DEPENDABLE . . . ECONOMICAL Service



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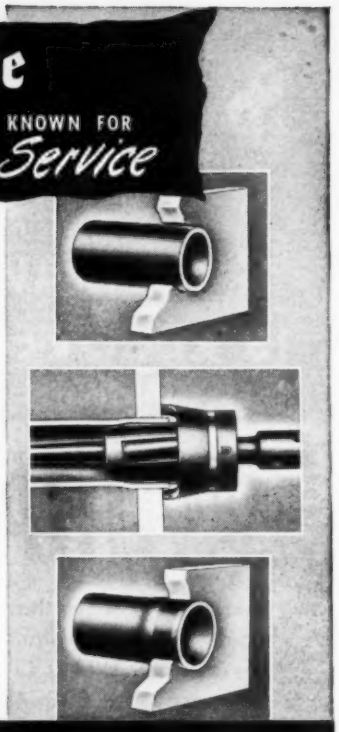

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The boilermakers' selection for more than a half century, for LOCOMOTIVE and general boiler work . . . guard straddles tube and bears against tube sheet, suitable for rolling new tubes and re-rolling tubes with flared or beaded ends.

MINIMUM FRICTION . . . absorbed by bronze bearing between guard and frame, resulting in much easier and faster operation.

Long rolls have generous radius on end and will not create sharp offset within the tube.

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The Gustav Wiedeke Company

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ings are briefly described in 4-page bulletin that also contains general information on their uses and applications. Metallizing Engineering Co., Inc.

Impact Shock Material (4C). To explain the properties and functions of this unique material and to describe its more widely developed applications, the manufacturer has published a 36-page booklet. Data are presented in a form readily understandable, a discussion of impact shock, transmitted high-frequency vibration and noise, and the reduction of their destructive effect. Fabreeka Products Co.

Metalworking Lubricant (4D). The use of colloidal graphite in metalworking is the subject of a generously illustrated, 2-color, 6-page bulletin. Specific instructions are given for the use of four different types of dispersions in various phases of metalworking, as well as graphs that show the results of test runs. Acheson Colloids Corp.

Stud Welding (4E). Eleven different applications of stud welding are illustrated in a new 4-page folder. Uses shown include installation of roofing, siding, insulation, electrical equipment and various types of reinforcing for concrete and gunite applications. Nelson Stud Welding Div., Morton Gregory Corp.

Industrial Aprons (4F). Featured in this 4-page catalog section are descriptions and illustrations of the three types of Koroseal aprons, the acidproof, film and heavy duty. Also covered are various aprons made of different types of rubber, together with specifications and recommendations for their particular use. The B. F. Goodrich Co.

Matting (4G). Three new catalog sections describe and illustrate 8 different types of runner matting made of rubber and other materials. Specifications are included as well as various types of application. The B. F. Goodrich Co.

Fireproof Door (4H). Colorful and informative 4-page brochure complete with test photos describes new wood-faced fireproof door. The door has a fire rating from Underwriters' Laboratories for Class B and C openings. Kaylo Div. Owens-Illinois Glass Co.

Abrasive Grit (4J). Folder gives typical performance results on this non-metallic, silica-free blast grit. Also gives the advantages over sand for cleaning and finishing. American Wheelabrator & Equipment Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Plate Fabrication (4K). Colorful 14-page bulletin contains numerous photographs of items fabricated by this company. One page gives welding-procedure qualifications. One other entire section is devoted to construction details and specifications of all types of heat exchangers. Dowingtown Iron Works, Inc.

Communication System (4L). Literature describes a system of instantaneous communication that gives tight control over production through written contact with all departments from laboratory to shipping. Contains many suggestions that help avoid delays between divisions. Telautograph Corp.

Fire Extinguishing System (4M). Fully illustrated literature describes a new carbon dioxide fire extinguishing system for protecting your record vault or file room. American-LaFrance-Foamite Corp.

Corrosion-Resistant Alloys (4N). New edition of the 40-page booklet "Hastelloy High-Strength, Nickel-Base, Corrosion-Resistant Alloys" tells the complete story of the four alloys—what they are, how they can be fabricated, and also how they can be used to combat severe corrosion. Several pages in the booklet are devoted to descriptions and suggested uses of the various forms of the alloys. Proper procedures for the welding, heat-treating, hot-working, cold-working, surface preparation, machining, and grinding are also given. Haynes Stellite Div. Union Carbide and Carbon Corp.

Lubrication (4P). Pocket-sized book on industrial lubrication is titled "Eleven Ways to Cut Production Costs". Presents economical examples attained through modern handling and application of greases and oils for increased production use of machinery, and elimination of machine repair and labor costs. Alemite Div. Stewart-Warner Corp.

Metallurgy (4Q). Informative 24-page bulletin on modern metallurgy gives photographs and charts as well as tables and engineering data. It answers the question of which metal or alloy is best suited for a given purpose. Hunt-Spiller Manufacturing Corp.

Non-Slip Floor Plates (4R). Illustrated 8-page bulletin on abrasive rolled steel plates describes the advantages of non-slip, heavy-duty steel floors. Tables give dimensions and allowable uniform load in addition to fabricating data. Alan Wood Steel Co.

Protective Coatings (4S). Folder, "Matchless Long Term Protection" presents the story of sealing against moisture, vapor and corrosion. Contains a series of operational photographs and sketches together with factual data. Insul-Mastic Corp.

Centralized Lubrication (4T). "Studies in Centralized Lubrication," a 6-page booklet, presents a series of typical case studies. It shows the striking economies possible with a centralized system of lubrication. The Farval Corp.

Air Hose (4U). Pocket-sized 4-page bulletin explains the design, construc-

tion and rubber compounds of this general-service rayon cord air hose. Hewitt Rubber Div. Hewitt-Robins, Inc.

Foundry Coatings (4V). Illustrated 4-page bulletin describes the use of colloidal graphite dispersions in the foundry. Contains many helpful application suggestions, in addition to descriptive formula on coating of chills, molds, and patterns. Acheson Colloids Corp.

Engineering System (4W). Illustrated 28-page booklet shows how a system of uniform engineering, design, procurement and construction does the job of modernization or expansion from flowsheet to operation of the plant. The Kuljian Corp.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Sand Conditioner (4X). Bulletin describes the operation of a new unit that cuts, magnetically separates, screens and piles foundry molding sand. American Wheelabrator and Equipment Corp.

Welding Accessories (4Y). Illustrated 32-page catalog covers complete line of holders, helmets, cable, ground clamps, goggles, cleaning tools and protective clothing. Gives complete descriptive data and specifications including data on replacement parts. Metal & Thermit Corp.

Airless Blasting (4Z). Illustrated 24-page booklet discusses the method of airless blasting, types of machines, and applications of the process to metal cleaning, finishing and shot peening problems. Contains photographs, line drawings and diagrams. American Wheelabrator and Equipment Corp.

Carbide Chart (5A). Chart outlines the carbide grade recommendations of leading manufacturers and specifies carbide grade equivalents. Suitable for hanging on the wall, it contains data of nine principal carbide companies. Windt-Sonis Co.

Electric Drill (5B). Catalog sheet shows comparative data with other leading electrical drills in power, weight and price. Back of the sheet contains construction features and specifications. SpeedWay Manufacturing Co.

Stainless Steel Walls (5C). Booklet is an interim progress report on proposed methods of curtain wall construction. Prefabricated stainless steel sheathing sections backed by insulation can replace masonry or other materials in exterior walls. Examples explained are the result of two years developments. Scale drawings illustrate existing and planned types of curtain walls with specific attention to such details as facings, insulation, vents, window sections, joints, shapes and textures. Allegheny Ludlum Steel Corp.

NOW... "PUSH-BUTTON" UNLOADING
PRICED LOW ENOUGH FOR ALL!

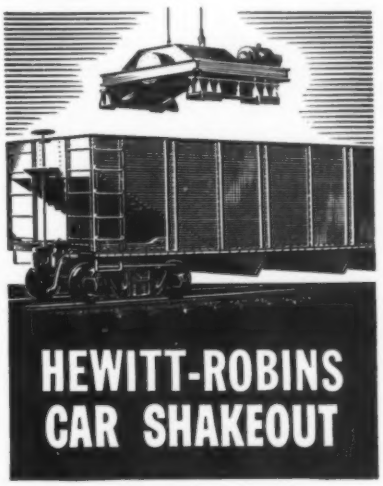
Fast, efficient car unloading can now be yours *at a cost so low you can no longer afford makeshift methods!*

Hewitt-Robins, originators of the Car Shakeout which has unloaded over 400 million tons of material from hopper bottom cars, makes this possible with the *all new* Hewitt-Robins GS Shakeout. This powerful, rugged shakeout—ideal for the smaller-size plant—is designed to unload *up to 15 cars a day*, yet is so economical you can afford to use it for *only two or three cars a day*.

Built-in controlled vibratory action makes the Hewitt-Robins GS Shakeout completely effective and enables the use of smaller, lighter, less expensive hoist and supporting structures—another economy feature for the smaller plant.

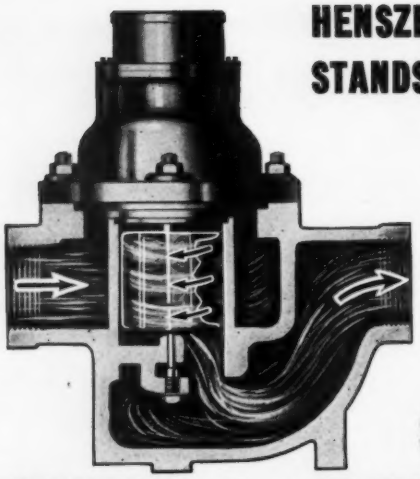
And remember, the Hewitt-Robins GS Shakeout gives you all the *plus* advantages introduced by the original Hewitt-Robins HD Car Shakeout: (1) you save time, (2) you save labor, (3) you save money, (4) you reduce demurrage charges, and (5) you eliminate danger to workers.

Learn more about this better, *proven* way to unload hopper cars! Write Robins Conveyors Division, Hewitt-Robins Incorporated, Passaic, N. J.



HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS



HENSZEY *Feed Water* METER STANDS UP *where others* FAIL

The cutting, abrasive action of hot, dirty Boiler Blowdown quickly breaks down meters that depend upon close clearances and intricate parts for their accuracy. Henszey Meters stay accurate—stay on the job—accurately measuring Boiler Blowdown, Feed Water, Condensate, Free-Running Chemicals and other "hard-to-measure" liquids. For details consult Sweet's Catalog or write:

HENSZEY CO., Dept. A8, WATERTOWN, WISCONSIN

HENSZEY

FEED WATER METERS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Boiler Feed Regulators • Flow Indicators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 17)

throughout, wearing rings, and flanged and bolted bowl construction. New casting and machining methods have been developed to assure high efficiencies and accurate manufacture.

Either oil or water lubricated pumps are available, arranged for motor drive, right-angle gear drive, or belt drive. They are suitable for a wide variety of services, including installation in wells for irrigation, industrial and municipal water supply, for installation in sumps, tanks, reservoirs or streams, and for pumping water, refinery products, and other liquids.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

330—CONTROL DRIVE IS PNEUMATICALLY OPERATED

Characterized control drive, which can be "tuned" to the requirements of a special application, is the latest development of Bailey Meter Co. This completely enclosed air-operated drive consists of a double acting air cylinder, a positioning relay, and a manually operated wheel or lever. A positioning relay provides the drive's characterizing feature, and a cam determines the relation of control drive position to control loading pressure. Three cams are included with each drive. These may be used interchangeably to obtain positions that are proportional to

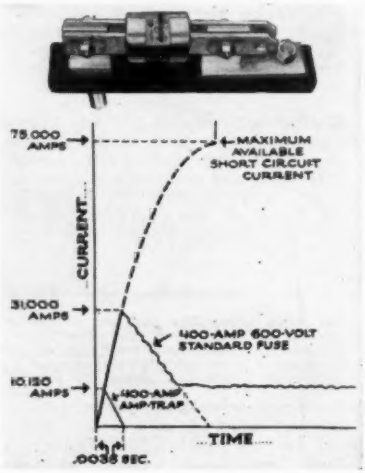
the first power (straight line), square, or square root of the control loading pressure.

Manual operation is simplified by an air supply shut-off valve, a by-pass valve, hand lever or wheel and a clamping device.

331—PROTECTIVE DEVICE LIMITS FAULT CURRENT

Current limiting device for protection of low voltage switchgear, bus ways, circuit breakers, transformers and other electrical installations against short circuit damage has been marketed by The Chase-Shawmut Co. Of a unique design, Amp-trap interrupted a test circuit in only 0.0035 sec and permitted a maximum short circuit current of 10,120 amp. A fuse, on the other hand, exploded at 31,000 amp and did not clear the circuit.

When a short circuit current develops, a



silver link embedded in sand, quickly melts and partially vaporizes, breaking the circuit in a matter of micro-seconds. The silver vapor is virtually a non-conductor. The heat of the arc is absorbed by the quartz sand, and the arc itself is quenched as it converts the sand into a glass fulgerite.

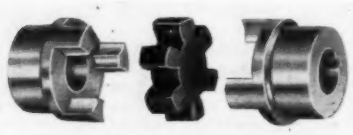
332—CASTERS HAVE HARDENED RACEWAYS

Steel-forged, flame-hardened Rapistan casters are announced by the Rapids-Standard Co., Inc. They are designed for heavy-duty service on racks, dollies, and portable equipment in many industries. Long life and fast swiveling action on all types of floors are insured by the flame-hardening process that produces an extremely hard wearing surface in the ball raceways.

The 500-series casters are equipped with 2½ in. wide wheels, with diameters of 4, 6, 8, or 10 in. in either swivel or rigid types. Models are available with nicro-steel, plastic, molded-on rubber, or V-trac wheels.

333—FLEXIBLE COUPLING HAS CONCAVE JAWS

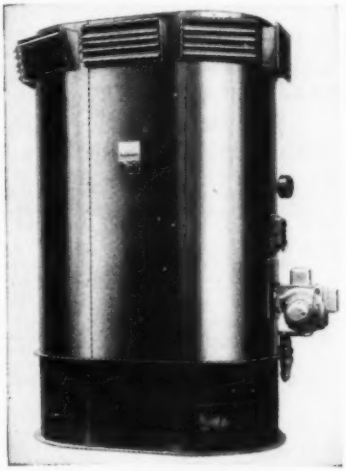
Specially designed concave jaw surface of the flexible coupling made by Gerbing Mfg. Corp. actually holds resilient synthetic rubber insert or spider in position. Any tendency of the rubber to extrude or break is



eliminated. Metal jaws are manufactured to close tolerances, and inserts represent the latest development in oil-resistant synthetic rubber. Available for shafts from ½ in. to 1 5/8 in. and hp ranges from fractional to 25. Standard keyways are provided. Information and data sheets are available.

334—PRAT-DANIELS ADDS TO HEATING LINE

Single large unit heater, where multiple smaller installations are impractical, has been announced by Prat-Daniel Corp. The



unit, specified as THERMOBLOC MODEL 1000, delivers 1,000,000 Btu's per hr. It occupies a floor area of 44 by 70 in. and is only 9 ft.-7 in. high.

Advantages of past models have been retained: high efficiency from 82-86%, boiler construction, comparatively small floor area for output, completely automatic operation and the minimum maintenance requirements.

Louvered outlets distribute low velocity, heated air, eliminating excessive drafts. Designed as a circulator of cool air during the summer.

335—FIRE DETECTOR HAS 120 x 80 FT COVERAGE

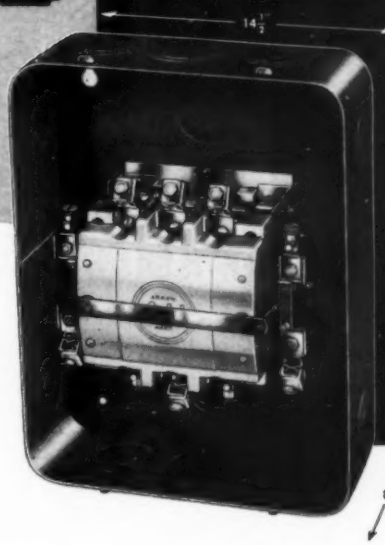
Fireye Corp. fire protection system FD-10 provides coverage throughout a room or fire zone and does not have to be located where it will be directly exposed to fire. The

photoelectric principle on which it is based is capable of detecting a very small fire, yet is designed to ignore extraneous light of any intensity. The unit consists of six de-

NEW SIZE 4 "RA" MAGNETIC STARTERS

ARROW AH HART

1/2 CONVENTIONAL SIZE



- EASY TO WIRE
- EASY TO SERVICE
- SILICON-CHUTE ENCLOSED CONTACTS

SIZE 4 ILLUSTRATED

SMALLEST SIZE 4 ON THE MARKET — Patented "RA" (Right Angle) Balanced mechanism cuts space in half. HIGH ARC RESISTANCE — Long arc path; silicon-chute enclosed contacts, shaped to force arc to extinction. EASE OF WIRING AND SERVICING — Straight through wiring, plenty of working space in the box; terminals front-wired; line and loads connect at opposite ends. 4-PILLAR ALIGNMENT — Assures straight line action, greater stability. FOR ITS SPACE-SAVING FEATURES, FOR ITS WORK-SAVING FEATURES, THE NEW AH SIZE 4 "RA" MAGNETIC STARTER IS THE SENSIBLE ONE TO SPECIFY AND BUY.

Write today for literature on Arrow-Hart Type "RA" Magnetic Starters, available in local and remote control or selector switch types — all sizes.

CONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

ARROW AH HART

1208 HAWTHORN STREET
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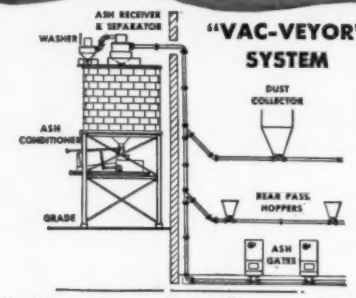
ARROW·HART

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD 6, CONN. U. S. A.

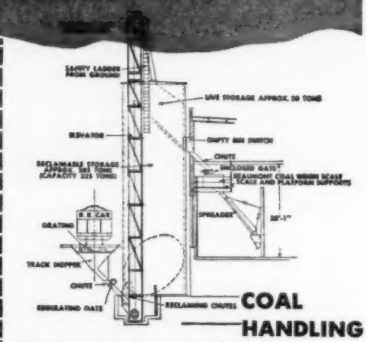
BRANCHES IN: BOSTON, CHICAGO, CLEVELAND, CINCINNATI, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA, SAN FRANCISCO, SYRACUSE
IN CANADA: ARROW-HART & HEGEMAN (CANADA) LTD., MT. DENNIS, TORONTO

Profits Saved AT EVERY STAGE . . . WITH BEAUMONT COAL & ASH HANDLING EQUIPMENT



"VAC-VEYOR" SYSTEM

In this system, ashes, siftings, soot and dust are conveyed by pipe from the ash pits, dust collectors, stack, etc., to an ash receiver and separator at the top side of a silo—by means of a vacuum. One man operates the system, keeping your plant cleaner with less labor. Send for Catalog.



COAL HANDLING

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down chute to yard storage. One operator controls all equipment. Send for Catalog.

BEAUMONT BIRCH Company

1509 RACE STREET—PHILADELPHIA 2, PENNA.

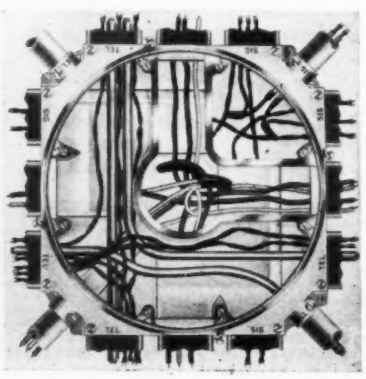
Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

tectors and one control panel. It provides coverage up to 120 x 80 ft. For areas larger than this, combinations of protection blocks may easily be made.

An electrical pulse of sufficiently low intensity to prevent a fire alarm indication is continuously applied through all circuits. Loss of this signal from any wiring or component failure will actuate a relay to give a distinctive trouble warning.

336—JUNCTION BOXES SEPARATE WIRING

Three, shallow, pan-type junction boxes for "Nepcoduct" one, two or three duct underfloor wiring systems are being marketed by National Electric Products Corp. Designed for installation with shallow concrete slabs, open-web steel joist construction, steel decking, or cellular floors, the new boxes occupy only 2½ in. of top floor construction.



All ducts enter on one level, with an interior design placing the low potential wiring area always at the top level of the box. Junction boxes are provided with adjusting screws for raising, lowering and leveling.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

337—STABILIZED D-C INDICATING AMPLIFIER

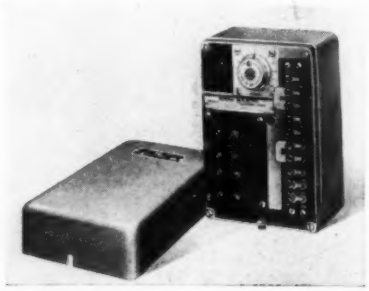
Multi-purpose, stabilized, d-c indicating amplifiers just announced by Leeds & Northrup Co., are useful for low-level d-c measurements as direct-reading microvoltmeters or micro-microammeters; as recorder pre-amplifiers to extend the range of standard recorders; and as high-sensitivity, short-period null detectors in place of galvanometers. Amplifiers are supplied either as voltage or current type, with choice of zero-left or zero-center, built-in, 4-in. indicating meter.

Both gain and zero point are so highly stabilized by a combination of a-c amplification and d-c null-balance feedback that trimmer controls are unnecessary. Without impairing performance, the voltage amplifier can be used with sources up to 10,000 ohms resistance, and the current type, with sources of 1,000,000 ohms and higher.

Basic range of the voltage amplifier is 0 to 50, or -25 to +25 mu v, with scale multipliers of 1, 2, 4, 10, 20 and 40; of the current amplifier, 0 to 1000 or -500 to +500 mu-mu a, with multipliers of 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, and 2000. Response time of both models is 2 to 3 sec. Output at recorder connector for fullscale input on any range is 10 mv at output impedance of 500 ohms.

338—COMPACT TIMER HAS HIGH CAPACITY

Providing automatic control of operation, limit, and sequence timing for many industrial processes, this timer has been announced by General Electric Co. It is available in



three time ranges: .06-1.2 sec, .6-12 sec, and 6-120 sec.

Some applications of the new device are: (1) operation timing to control duration of processes (2) limit timing and (3) sequence timing with two or more timers in combination. The relay armature is the only moving part. Load ratings are: inrush—15 amps, carry—10 amps, and break—5 amps.

339—MAGNETIC PARTICLES CONTROL POWER

First commercially-usably, magnetic-particle clutches have been introduced by the Vickers Electric Div. It is a controllable coupling which utilizes the linking action of a dry magnetic mixture in a magnetic field between driving and driven parts to transmit torque. The mixture is composed of iron particles and flake graphite. The magnetic field is established by current in a coil, and the degree of clutching can be controlled by varying the current.

Advantages include: (1) small control power with extremely fast response, (2) no wear on torque transmitting surfaces, (3) torque at zero slip, (4) large maximum to minimum torque ratio and (5) easy adaptation to remote control.

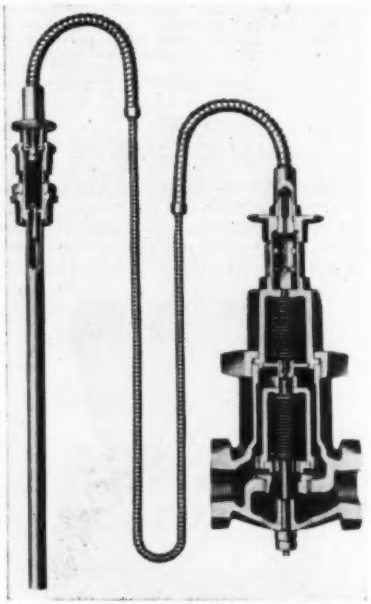
340—DIESEL SUPERCHARGER

Largest capacity engine superchargers ever to be produced in this hemisphere are now being built by The Cooper-Bessemer Corp. Designed specifically for type LS and LSV engines, the new superchargers are of such size and design as to handle the requirements of any gas or diesel engine from 1200 to 2500 hp. Manufacture of these engine superchargers resulted from the inability to secure units of such size in this country.

341—BELLOWS VALVE REGULATES TEMPERATURE

Stacon, the self-operated, hermetically-sealed temperature regulator, is again on the market with the formation of the Farris Stacon Corp. In this regulator, temperature change to move the valve disk full travel, is less than 3 deg, and plus or minus 1 deg control is claimed.

Operation is based on a vapor flash principle, which provides split-second control. As liquid in control bulb expands with increase in ambient temperature, it is forced



into a steam jacketed power bellows and immediately flashes to vapor; pressure thus generated—99% due to loading steam temperature—extends the bellows, which throttles the valve.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

342—CENTRIFUGAL PUMPS FOR MOTOR MOUNTING

Pumps that mount on any motor which has NEMA type "C" mounting flange, have been introduced by The Deming Co. Indentified as "MOTOR-MOUNT", these pumps are made in vertical and horizontal types, each type made in 25 standard sizes. Capacities range up to 200 gpm; heads up to 165 ft, motors ¼ to 7½ hp. Speeds are

WRITE FOR *New* STOKER *Bulletin*

It tells how the Chicago Automatic Stoker meets the over-all Firing Requirements for a Wide Range of Steam Demands

Other pertinent information and typical layouts are included in this new spreader stoker bulletin now available for distribution. The Chicago Automatic with its many operating advantages and features of design is firing numerous types of boilers with variable load requirements for important commercial and industrial concerns.

For your copy of the new Chicago Stoker Bulletin, Publication No. 85, address Dept. C-8, The Standard Stoker Company, Inc. 370 Lexington Avenue, New York 17, N. Y.

THE STANDARD STOKER CO • INC •

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7

reasons you'll rate R B R compound 1st for your wire-pulling jobs

This new compound is designed specifically to give you maximum performance in pulling rubber covered, asphalt coated and other types of covered wire. Check these 7 values Albany R B R compound gives you:

1. **Inert.** R B R does not dissolve or soften rubber or other coatings.
2. **Will not separate.** Requires no mixing or stirring prior to use.
3. **Clean.** Light in color, no dirty clothes or hands. May be removed by washing with water.
4. **Permanent.** Allows easy removal of wire if necessary in later years.
5. **Non-evaporating.** Won't dry out in the can. May be taken from job to job after can is open.
6. **Less stress.** Dynamometer tests show lower stresses than with ordinary compounds.
7. **Easy to apply.** May be readily swabbed or brushed on wire.

For speed, ease and economy, use Albany R B R compound. Available in 10 and 25 lb containers; 125 and 500 lb drums.

Send for free sample and literature.

ALBANY LUBRICATING COMPOUND

ADAM COOK'S SONS, INC.
Mfrs. of Albany Lubricating Products
LINDEN, NEW JERSEY

1750 and 3500 rpm. Maximum total pressure is 125 lb, maximum suction pressure, 50 lb. Maximum recommended liquid temperature is 200 F.

Standard packing type stuffing-box head is interchangeable with mechanical shaft-seal type head. Pump shaft is stainless steel, fitted with compression coupling to assure alignment of rotating parts, and the impeller is an enclosed type with non-overloading characteristic.

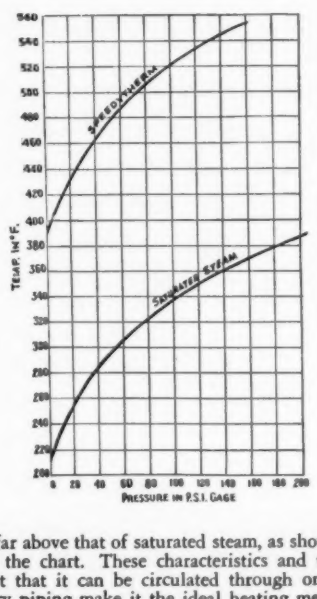
343—SOCKET WRENCH WEIGHS 67 POUNDS

Manufacture of a special socket wrench with a 6 in. hexagonal opening—the largest Proto socket ever built—has been announced by the Plomb Tool Co. The socket was de-

signed for use with impact equipment by the road maintenance crew of a large water and power utility. It has an OD of 9¼ in., a length of 8 in., a drive size of 1½ in. and weighs 67 pounds.

344—HIGHER TEMPERATURES AT LOW PRESSURES

The Livingstone Engineering Co. announces the Speedytherm Boiler, which uses the electrode principle, but instead of water, Speedytherm liquid is substituted. This material functions exactly like water except that its boiling point is much higher and its vapor temperature, at any given pressure,



is far above that of saturated steam, as shown on the chart. These characteristics and the fact that it can be circulated through ordinary piping make it the ideal heating medium for platens, molds, jacketed kettles, and autoclaves, where working pressures must be limited, and where desired temperatures are in the range from 400 F to 550 F.

345—STUD MOUNTS FOR VIBRATION CONTROL

Stud-type vibration isolators, a product of Finn & Co., control transmitted vibrations when installed either in compression or shear. Each mount features the floating-rubber principle. A rubber cylinder is rigidly bonded to steel end plates to which studs are welded. One stud can be bolted to a foundation, the other to a piece of equipment. Adhesion between contacting faces of metal and rubber is so great that it is not necessary to anchor the studs within the rubber, affording maximum dampening efficiency.

All stud-type mountings are essentially the same design, and are available in 44 different sizes, for load ranges from 1 to 270 lb per mount. These isolators lend themselves to use with small motors, engines, lathes, radios, switches, air conditioning, lighting equipment, sensitive instruments, and many other installations.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

346—VOLTMETERS DRAW NO CURRENT

Electrostatic voltmeters, offered in portable and panel types by Cole Instrument Co., operate on the attraction or repulsion between two electrical surfaces, and are used to measure high voltage outputs where no

current can be drawn. The accuracy as stated, is 1% of full scale value. The movement is shielded to avoid errors due to stray external field. It is furnished in single ranges, full scale from 120 v to 12,000 v and multi-ranges 120/240 to 1000/3000/7500 v.

347—THERMOCOUPLE SPEED INCREASED 9 TIMES

Thermocouples having speed responses up to nine times that of previous models have been developed by Minneapolis-Honeywell Regulator Co. They also are improved by new butt-welding techniques.

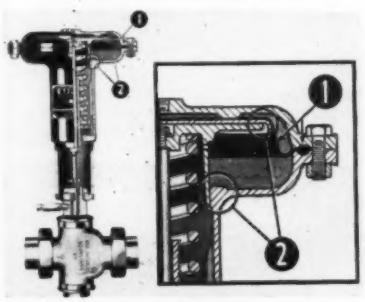
Increased speed of response has been made

possible by three major improvements: (1) the mass of the hot junction is considerably reduced in the 8-, 14-, and 20-gage types; (2) the thermocouple wire is shaped to form a loop close to the hot junction and the insulator is faced about one inch from the welded tip, reducing conduction from the cold end; and (3) the dimensions of the loop permit it to fit tightly inside a well, furnishing metal-to-metal contact and eliminating dead air space.

The thermocouples are manufactured by the Brown Instruments Div.

348—AIR OR WATER OPERATES VALVE

Introduced by the Powers Regulator Co., this diaphragm valve is designed for air or water pressures below 250 psi. Comes in sizes from ¼ to 8 in. It regulates the flow

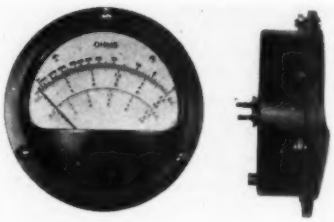


of steam, water, oil or grease.

Features include neoprene diaphragm with positive sealing bead, floating plate that absorbs side thrust, starting pressure adjustable from 0 to 17 psi, with full travel for 5 to 10 psi control pressure change. There are a variety of valve bodies and connections.

349—HERMETICALLY SEALED METERS ARE THIN

This 4½ in. instrument brings features of Marion Electrical Instrument Co. Hermetic line to users who require this size. Solder-type zero-adjuster provides adjustment with-



out breaking the hermetic seal. A rubber gasket is included for use as a pressure seal for panel mounting.

Meter has a depth of only 1 ⅛ in. from front of panel and is now offered in a wide variety of standard ranges. Either 1 or 2% accuracy rating available.

350—UNITS CONDITION AIR FOR PNEUMATIC TOOLS

Pneumatic control units, recently added to the Victor Equipment Co. line, when used together prevent condensation, keep water, scale and dirt out of airlines and lubricate the air.

The filter uses a sintered bronze unit to

CLEAN SMALL TUBES FAST

With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. Very little headroom is required for either vertical or horizontal tubes. Tube bundles can be cleaned without removal from shell.

The unusual power developed by the ROTOJET Motor is due to its simple design and exclusive Rotocentric (egg-shape) bore cylinder. A shaft and a blade are the only moving parts. Positive contact between blade and cylinder is always maintained. No leakage. No stalling at low speeds. Water-driven motors are also available.

Try ROTOJET Junior, and you will never go back to heavy, slow, external type cleaners costing many times more.

in
★ BOILERS
★ CONDENSERS
★ EVAPORATORS
★ SUPERHEATERS
and other
★ TUBULAR APPARATUS

532 ROTOJET Junior Air-driven Motor, universal joint, cone cutter.

C324 ROTOJET Junior Water-driven Motor, univ. joint, pivot head

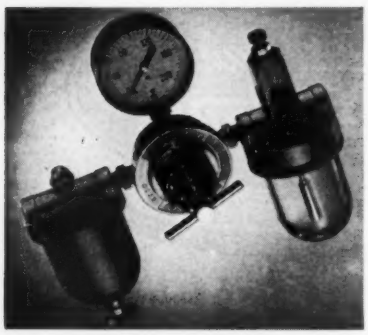
C439 ROTOJET Junior Air-driven Motor, universal joint, drill head

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

SEND FOR ROTOJET JUNIOR BULLETIN

ELLIOTT COMPANY-ROTO DIVISION
156 Sussex Avenue **Newark 1, N. J.**

trap dirt and condensation. Regulator features minimum pressure drop. Lubricator, with very fine visible oil adjustment, may be obtained with steel or plastic oil cup, which



can be cleaned or filled without interrupting air flow. Available in ¼ or ⅜ in. pipe size at present, ½ and 3/4 in., later.

351—NON-MELTING LUBRICANT REPLACES GREASE

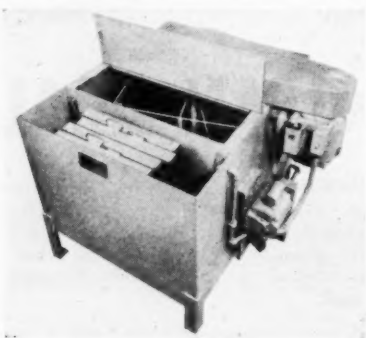
Development of a new, all-purpose lubricant, which has no melting point, is announced by The Warren Refining & Chemical Co. Known as "Plastilube", the new product has been called the successor to grease, since it contains neither metallic soaps nor fatty acids, and has greater adhesiveness, excellent pumping qualities at low temperatures, and does not break down.

Adaptable for almost any automotive and industrial use, tests show longer service life, combined with greater safety and economy.

It is claimed that the development of the non-melting lubricant may be the most significant event in the field of lubrication since the first use of additives in oil. Two years of laboratory research were correlated with a four-year basic program independently conducted at the Mellon Institute.

352—WASHING MACHINE MAINTAINS AIR FILTERS

Utility washing and oiling machine for servicing viscous, impingement, panel-type air filters has just been announced by the



Farr Co. It is a modified version of previous models at considerably lower cost.

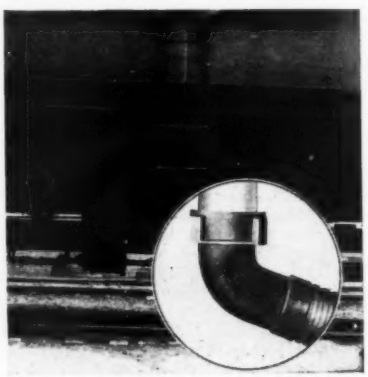
It is claimed that use of the washer and oiler reduces air filter maintenance costs as much as 67%, substantially increases filter life, assures positive oiling, and permits lower inventory stock. The unit can be operated by one inexperienced man because all controls are automatic.

353—SOLID SWITCHBOX EASY TO INSTALL

A switch box, called the Levelock, has been announced by General Electric Co. Designed for faster installation, this new box has an improved locking mechanism that wedges the side plates tightly in position. This allows it to take severe abuse without dislodging the side plates. An extra set of nail holes is provided for rapid mounting to studding. Four contact points on the side plates allow mounting with no rocking or tilting and side pryouts take care of out-of-the-ordinary installations. Single-screw ear allows adjustment from better than flush to 5/8 in. below the edge of the box.

354—SPARKPROOF COUPLING IS LIGHT IN WEIGHT

Unloading tank cars containing petroleum products or liquid chemicals will be less burdensome and much faster by use of a non-ferrous elbow coupling introduced by



the Atlantic Metal Hose Co. It is less than 1/3 the weight of malleable iron couplings now in general use, and one man can attach it without heavy, unweildy wrenches. In addition, it possesses high tensile strength and non-sparking qualities.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

355—BEARING UNIT IS QUICK MOUNTING

Ball-bearing flange unit, designated as the FED series and featuring a streamlined, all-metal, 2-bolt style housing, is manufactured by the Ahlberg Bearing Co. It is designed for small shaft equipment where light loads and normal speeds are imposed. Other fea-

Save Fuel!

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For higher combustion efficiency, less fuel loss, the Engelhard CO_2 Analyzer gives complete, sensitive, accurate analyses by the thermal conductivity method perfected in the Engelhard laboratories. Bearing the approval of the U. S. Bureau of Standards and other important authorities, the thermal conductivity method combines simplicity of equipment with extreme accuracy.

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CE-104

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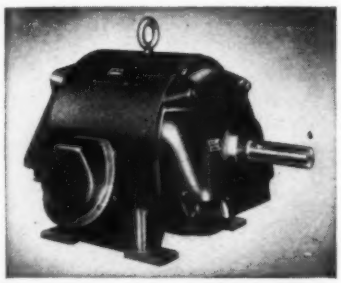
tures are precision internal self-aligning ball bearings and labyrinth-type seal, which eliminates drag and undue wear. A headless set screw locks the unit to the shaft.

356—SPLASH-PROOF MOTORS ANNOUNCED

Splash-proof, type CSP Life-Line induction motors are available from Westinghouse Electric Corp. These squirrel-cage motors are designed for constant speed applications both indoors and outdoors. They are fully protected from dripping or splash-

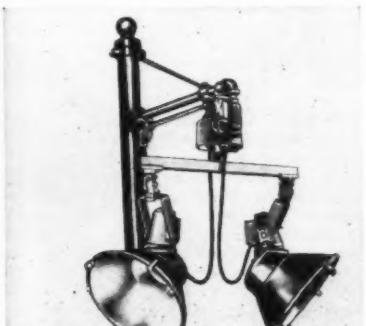


ing liquids by solid rolled-steel frames and baffles in the end brackets, and are equipped with prelubricated bearings.

Motors are rated at 7-½ to 100 hp; 60, 50, 25 cycles; 208, 220, 440, 550, 2300 v, with frames 364 through 445, NEMA standard dimensions.

357—HANGER CARRIES DUAL FLOODLIGHTS

Dual-floodlight suspension yoke announced by the Thompson Electric Co. has been designed for use with outdoor models of Thompson disconnecting and lowering hangers. It supports two bail-suspended



floodlights from a single hanger. Floodlights of different types and weights can be used with the yoke and can be balanced easily by a simple spacing adjustment on the channel. They are fabricated from corrosion resistant aluminum alloys for long service life in all weather and atmospheric conditions.

358—A-C WELDER USES SILICONE INSULATION

Portable, silicone-insulated, a-c welder has been announced by the Welding Div. of General Electric's Apparatus Dept. This insulation is unaffected by high temperatures and is water repellent. Compact construction, 12 by 17 in. in cross section, and

NO FOUNDATION COSTS!
THERE'S ONLY 1 PRICE TAG ON A SCHRAMM AIR COMPRESSOR!
Only one price—according to the size and model—that's all you have to pay for a SCHRAMM Air Compressor. No "hidden" extras such as foundation costs! And, did you ever stop to consider this item when buying an air compressor? If not, it will pay you to investigate as it can be mighty costly—and yet can be eliminated—by using a SCHRAMM!
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Write today for full details.
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The Compressor People
WEST CHESTER • PENNSYLVANIA

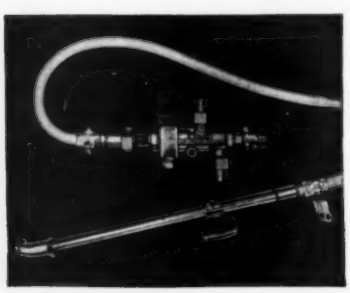
23 in. in height, permits using under-bench and balcony space. Weight is 154 pounds, making it portable. Current range is from 30 to 250 amp, and it accommodates electrodes from 1/16 to 3/16 in. di-

ameter. The standard model is designed for operation on 220 v. Models are available for operation on 440 v with or without power factor capacitors.

The automatic "hot start" control—composed of a hermetically sealed, gas filled, time-delay magnetic switch and a wound resistor—causes a surge of current during the starting period, higher at low currents than at high settings. Automatic reduction of boost at higher current setting avoids drawing current surges from the power line.

359—JET CLEANS DIFFICULT LOCATIONS

Hi-Pressure Jet Cleaner introduced by the Sellers Injector Corp. is known as model "B". The unit is small and compact for wall or post mounting, yet provides full efficiency in the quick, thorough cleaning of plants, treadways, freight cars, vats and



machinery. The cleaner provides a high-temperature, large-volume water jet at pressures adjustable up to more than twice the plant steam pressure. The combination washes away grease, slime, carbon deposits and other foreign matter that cannot be removed except by hand scrubbing or scraping.

Jet consists of a venture-injector mixing chamber which is simply connected to a steam and cold-water line, a 50 ft length of high-pressure hose, cleaning lance and special nozzle. A connection and control valve is provided for automatic addition of a detergent or solvent, if desired, in any proportion from 0 to 10 percent.

360—MOBILE CABINET HAS ADJUSTABLE DRAWERS

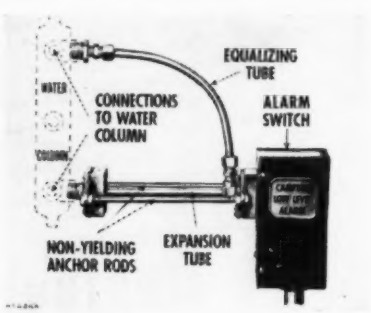
Interchangeability of drawers, which makes it possible for every buyer to custom build his own cabinet, is the biggest feature of the Proto "Toolmobile" tool cabinet announced by the Plomb Tool Co. Easy-to-move drawer

runners, which fit into notches spaced every 2 in. from top to bottom, permit any of three basic sizes of drawers (2, 4 and 6 in. deep) to be installed in any combination or arrangement.

Roller slots keep drawers from sliding open when the cabinet is moved. Adjustable dividers form various-sized compartments in the drawers. Tough rubber casters (5 in.) on ball-bearing swivel plates roll easily and quietly, and two have handy foot-operated brakes.

361—WATER-LEVEL ALARM IS SENSITIVE

Device to warn of low boiler water level has been announced by J. A. Campbell Co. It is actuated by an expansion tube connected to the lower end of the water column as shown in the photo. Because of radiation,



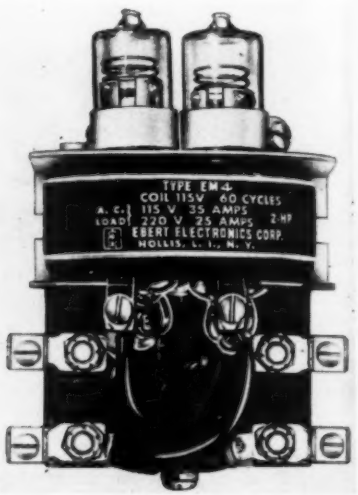
water in the tube is about 100 F cooler than the boiler water or steam. This differential permits a sensitive response to water level.

The micro-switch operated by the tube throws on an expansion of 0.0001 in., or on a 5-F temperature change. Screw adjustment is provided for any desired level. The switch may be connected to operate both an audible alarm and a solenoid valve in the fuel line.

For more information use one of the convenient reply cards on page 37. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

362—MERCURY RELAY HAS TWO POLES

Design developed by Ebert Electronics Corp. incorporates two standard EMT tubes in one coil structure. This produces an ef-



ficient arrangement for loads up to 35 amp, 115 v a-c or 25 amp, 220 v a-c with minimum size and cost. Over-all dimensions of the type EM-4 are 4-3/8 by 3-3/8 by 2-1/4 in. Available with NO or NC contacts, or for special applications, one NO and one NC contact.

363—AIR COMPRESSORS ARE PORTABLE

Two portable air compressors are being introduced by Worthington Pump and Machinery Corp. Hand truck and trailer models are featured. These two-stage, air-cooled compressors with 30 cfm capacity at 100 psi have a maximum operating pressure of 150 psi and contain the same mechanical features of larger Worthington portables.

Powered by a hand-cranked, air-cooled gasoline engine, the compressors have Worthington's patented feather valve, suction valve unloading, Air Maze oil bath cleaners and standard ASME air receivers.

364—PNEUMATIC TRANSMITTER FOR LIQUID LEVEL

Liquid level pneumatic transmitters will be introduced this month by Minneapolis-Honeywell Regulator Co. The transmitter, using buoyant force on a partly immersed cylinder, requires neither purges nor liquid seals, and can be operated for long periods with practically no maintenance. Its sensitivity is one part in 14,000, and has a reproducibility with plus or minus one per cent of full scale. Vibrations will not affect operation and level can be measured in practically any tank or container.

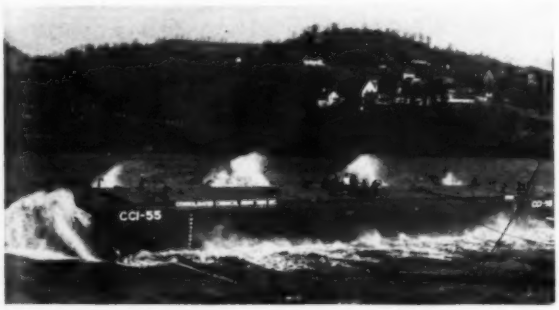
"SPOT" NEWS OF INDUSTRY

(Continued from page 109)

and Development is Dr. William P. Yant. A member of many technical societies and associations, he was the first president of the American Industrial Hygiene Foundation. In 1946, he received the Pittsburgh Award of the American Chemical Society for distinguished service to chemistry. Recently, he was appointed chairman of the steering committee of the U. S. Technical Conference on Air Pollution.

Second All Welded Steel Barge Added to Transport Sulphuric Acid

Based on the performance record of the first welded steel tank barge ever designed and built specifically for transporting sulphuric acid on the inland waterways, Consolidated Chemical Industries, Inc. has placed in service a



Making Warm Friendships on Hot Jobs

WATER JACKETED APCO PUMP

Developed especially for the efficient handling of high temperature and highly volatile liquids. Delivers outstanding performance. Unbeatable on high head, small capacity duties.

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For Every Purpose

WE STOCK STAINLESS STEEL APCO PUMPS

For the convenience of our engineer friends we carry for immediate shipment, popular sizes of Apco Pumps in STAINLESS STEEL.

AURORA CENTRIFUGAL PUMPS are available in many types and sizes—all noted for their streamline coordination between impellers and shells.

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THIS IS THE BLOWING VALVE

EVERLASTING DUPLEX BOILER BLOW-OFF UNIT, COMPLETE

A "regular" ***EVERLASTING*** Valve that opens fully with one short movement of the lever . . . a wheel-operated ***EVERLASTING*** Companion Valve built to take the full punishment of the blow-off . . . these two valves, coupled together, provide a combination that meets full code requirements for dual-valve blow-off.

The lever-operated ***EVERLASTING*** Valve, designed for unimpeded, straight-through flow, maintains its tight seal, because it re-grinds itself with each operation. It cannot wedge or stick.

The ***EVERLASTING*** Companion Angle Valve, designed specifically for blow-off service, stoutly resists erosive blow-off water and the abrasive action of solids in such water.

Either valve obtainable separately if desired.
For full information write us for ***EVERLASTING*** Bulletin.

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Conceal and protect sunken bolts and screws, in metal or wood, with Smooth-On No. 1 Iron Cement. Smooth-On will stay tightly in place, for it expands slightly as it hardens.

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Engineers, mechanics and maintenance men have been using Smooth-On for more than 50 years past for many such jobs as this. For bigger ones, too, sealing cracks, stopping leaks, tightening loose parts, etc. Order Smooth-On No. 1 in 7 oz., 1 lb., 20 lb. or 100-lb. size from your supply house. If they haven't it, write us. SO-168

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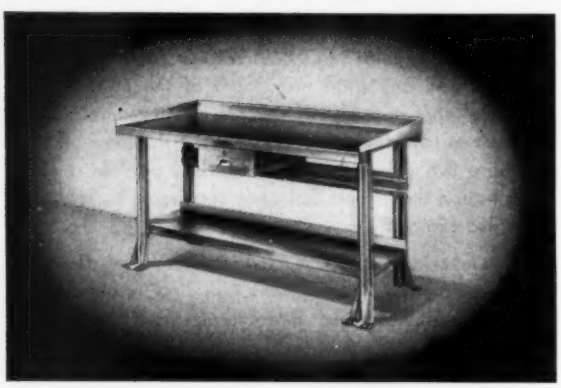
570 Communipaw Ave., Jersey City 4, N. J.

Do it with **SMOOTH-ON**
THE IRON CEMENT OF 1000 USES



The* HALLOWELL *WORK BENCH OF STEEL

Standardized, *ready-made* HALLOWELL Work Benches save trouble and expense of "building your own"; provide superior equipment for maximum productivity.

Interchangeable units readily adaptable to individual requirement. Easily bolted together to form continuous bench, yet may be taken down and reassembled as single units. Rigid, heavy-duty construction eliminates bolting to the floor, minimizes installation and maintenance.

HALLOWELL Work Benches do credit to any plant. Functional design and attractive appearance encourages better plant housekeeping and worker performance.

Full details in Bulletin 701.

HALLOWELL
SHOP EQUIPMENT OF STEEL
SPS STANDARD PRESSED STEEL CO.
JENKINTOWN 39, PENNSYLVANIA

second barge of the same type. Both vessels designed and built for Consolidated by Dravo Corp., solved a difficult transportation problem—moving large quantities of sulphuric acid safely, economically and speedily on the waterways.

Transporting sulphuric acid in bulk quantities was simplified because of the proximity of Intracoastal Canal and other waterways to loading and unloading points. But, careful study by Consolidated engineers and Dravo's naval architects was required to design a vessel capable of carrying such cargo.

One difficulty that had to be overcome was possible corrosion damage to the steel barge through acid spillage. Although sulfuric acid is not corrosive in the concentrated form in which it is shipped, spilled acid could be diluted by bilge water and become extremely corrosive. A departure from the conventional design of chemical barges provided the solution. This entailed decking over the entire vessel with outboard-sloping watertight steel plate. Thus, rain or spray cannot enter the hull and spilled acid can be readily washed overboard with a hose. The deck camber is 3 in. in 15 ft to give it suitable drainage.

The barges are 175 ft long, 30 ft wide and 10 ft-8 in. deep. Side decks are 3½ ft wide and provide ample working space for the crew handling mooring and cargo lines.

Astoria Plant Enters Expansion Program

What is considered the world's largest reheat boiler to generate steam for electricity has been purchased by Consolidated Edison from the Babcock & Wilcox Co. The unit will be installed in the new station in Astoria, Queens, along with other related equipment for generating electricity. First phase of the installation will cost $25,000,000, and it will be a part of Consolidated Edison's half a billion dollar expansion program.

"TROUBLE FREE" *Control . . .*

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SELF-OPERATING REGULATORS and DIAL THERMOMETERS
Constant Temperature Regulation for

- HOT WATER TANKS • PASTEURIZERS • PRE-HEATERS
- STORAGE ROOMS • VATS • PLATING TANKS
- COOKERS • FEED WATER HEATERS • WATER JACKETS

Cut your processing costs to a new low with the Trerice Self-Operating Regulator. This dependable, experience-proven regulator provides trouble-free control . . . eliminates over-heating! Saves you steam, fuel and labor while affording improved "quality control" over your product. Your low, initial investment in the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer, will be repaid many times over during their first year of service.

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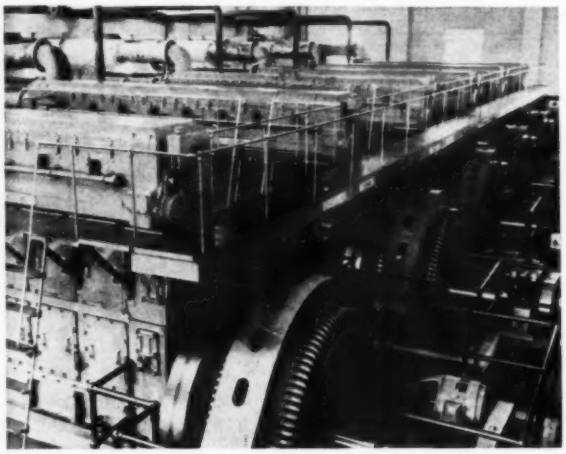
As high as a 14-story building, the boiler will produce 1,200,000 lb of steam per hour or sufficient to generate electricity for a city of 400,000 people. It will be built in the company's plant in Barberton and Alliance, Ohio and Beaver Falls, Pa. and shipped in sections and assembled at the site.

This unit is designed to burn oil but provisions have been made for future installation of coal burning equipment. Steam will be developed at 1000F. A total of 10,000 gal of oil will be burned per hr.

Sixth Diesel Engine Added to New Bern's Municipal Plant

New Bern, North Carolina, has added a diesel engine to their municipally owned diesel electric power plant. The



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A UNION FOR *every job*... AND EVERY ONE A *master* OF ITS JOB!

There's a WECO UNION that is exactly right for every job. You can be sure of a perfect seal even after repeated use . . . sure of faster make-up and a longer life of leak-proof service . . . WECO UNIONS are available in sizes ⅛" through 10"; 1,000 lbs. to 15,000 lbs. test pressures. Wherever you need a Union, you need a WECO. Ask a Weco Representative or write for catalog of "The most complete line of Unions in the World."

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Subsidiary of Chiksan Company
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Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

New *VERSENE test kit determines total water hardness in less than *TWO MINUTES***

Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

Order The New Versene* Water Hardness Testing Kit today. $3.00 Postpaid. Send Checks or M.O. No C.O.D.'s. Money Back Guarantee.

We also manufacture and supply Inhibited Indicator and Di Sodium Versenate (the di sodium salt of ethylene diamine tetra-acetic acid). These are the reagents used in the Versenate (Schwartzenbach) Method for the determination of Water Hardness.

Di Sodium Versenate
50 g. $2.00 100 g. $3.00 500 g. $10.00

Inhibited Indicator
100 cc $1.00 250 cc $2.00 500 cc $3.00 1000 cc $5.00

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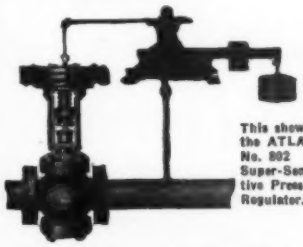
Super-Sensitive
PRESSURE REGULATORS

Here is a verbatim report by an ATLAS representative: *"First, a diaphragm valve did not regulate close enough. Second, a pilot operated valve did no better. Then they installed an ATLAS No. 802 Super-Sensitive and since then operation has been just about perfect."* Names on request.

In other words **THE JOB WAS TOUGH** for other regulators, but it **was EASY** for an ATLAS Super-Sensitive Pressure Regulator which maintains constant controlled pressure within fractions of one pound without perceptible variations under unusual and even difficult conditions, as, for example, where there is a wide fluctuation in demand and considerable variation in initial pressure.

Ask for Bulletin No. 1B.



This shows the ATLAS No. 802 Super-Sensitive Pressure Regulator.

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REGULATING VALVES FOR EVERY SERVICE
287 South St., Newark 5, N. J.
Represented in Principal Cities

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☐ Please send bulletin No. 1B on the Super Sensitive Pressure Regulator. Also please send information on the following ATLAS Products.

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☐ Reducing Valves
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☐ Humidity Controllers
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For a better drive, select the proper Cleveland unit

WRITE for copies of the latest Cleveland catalogs for full information on all types and sizes of worm gear speed reducers —including rating tables, dimensional diagrams and data for both standard and fan-cooled units. Ask for Catalog 200 for standard drives and Catalog 300 for Speed-aire (fan-cooled). The Cleveland Worm & Gear Co., 3253 East 80th St., Cleveland 4, O.

CLEVELAND
Worm Gear
Speed Reducers

plant, completed in 1948 at a cost of $600,000, now contains six engines, all supplied by the National Supply Co. This Atlantic Coast city of 20,000 inhabitants has owned and operated its own power plant for almost 45 years. Prior to 1948, the city had steam turbine-driven generators. In 1947, although operating all available equipment, part of the city's electrical needs had to be purchased. It was this situation that led to the building of the new plant.

Before deciding on diesels, city officials considered three methods to supply necessary power: (1) purchasing the amount of power needed; (2) building a new steam plant and moving the steam equipment owned at that time; and (3) building a diesel plant.

Comprehensive economic studies were made to determine the relative merits and costs of each of these plans. Results showed conclusively that a diesel electric plant would more nearly solve the city's power problems. A contract was let for five 1000-kw supercharged diesels. The sixth engine is a duplicate and its eight cylinders of 14½-in bore and 20-in. stroke produce 1440 hp at 360 rpm. The unit is equipped with oil cooled pistons, Woodward hydraulic governor, duplex fuel oil filter, automatic alarm and emergency shut-down systems.

Lubricating system is a force-feed, dry-sump type with a rotary pump unit mounted at the control end of the engine and driven by silent roller chain from the crankshaft. Lubricating oil cooler is of the shell and tube type.

Promotion Committee Announced By National Planned Lighting

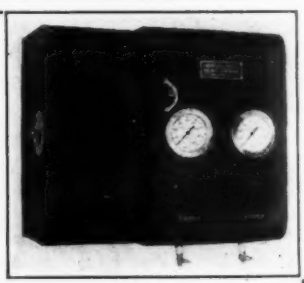
Members of the National Promotion Committee of the Planned Lighting Program, which has been organized by Edison Electric Institute to keep the electrical industry informed of new developments in Planned Lighting Sales

"LIQUIDS WORTH STORING ARE WORTH MEASURING" WITH A LIQUIDOMETER *Tank Gauge*

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

with H & T poppet type multiport valves



you can convert your obsolete water softeners to "push-button" operation

H & T poppet type, multiport valves are easily installed on old, manually operated water softeners

- fully or semi-automatic
- time and labor-saving
- non-sticking; non-leaking
- simple, efficient operation

Write today for Bulletin V-1

HUNGERFORD & TERRY, INC.
Clayton, New Jersey

Over 50 years experience—Over 5,000 installations

activities, have been announced by Joseph S. Schuchert.

Organization will be on a regional basis, with every section of the United States represented by a leading figure in lighting promotion. The committee will serve as a clearing-house for successful planned lighting promotional and educational ideas used in all markets by every element of the industry. Committee members will sparkplug planned lighting activities in their assigned area; and information will be passed on as to how this program is being used successfully, and how it serves as a source of new promotional suggestions and materials. Thirteen regions were set up with a committee member responsible for each.

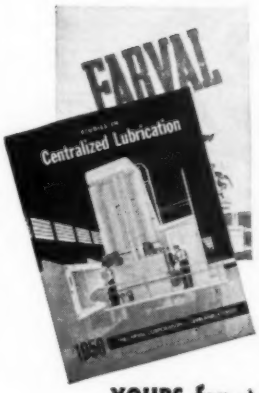
New Nonferrous Induction Heating Technique Revealed

Technique for induction heat-treating of nonferrous metal strip such as aluminum, brass, copper, magnesium and stainless steel—called "Transverse Flux Induction Heating"—was recently revealed by R. M. Baker, Westinghouse Electric Corp.

Mr. Baker declared that transverse flux induction heating is the only practical and economical method for the continuous induction heat-treatment of nonferrous strip. Conventional radio-frequency induction heating, so admirably suited to the heating of magnetic steel strip, is not suitable for heating nonmagnetic strip. Low power factor, inefficiency, and small cross section of the nonmagnetic strip intercepts only a very small percentage of the flux through the inducing coil. The transverse flux method overcomes this difficulty, since magnetic flux is directed perpendicular to the surface and through the strip—instead of along its length, as in radio-frequency induction heating.

This induction heating is accomplished by passing the

New report on savings with centralized lubrication



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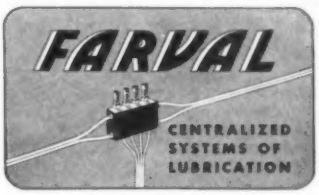

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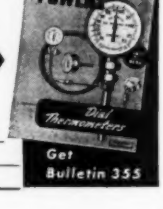

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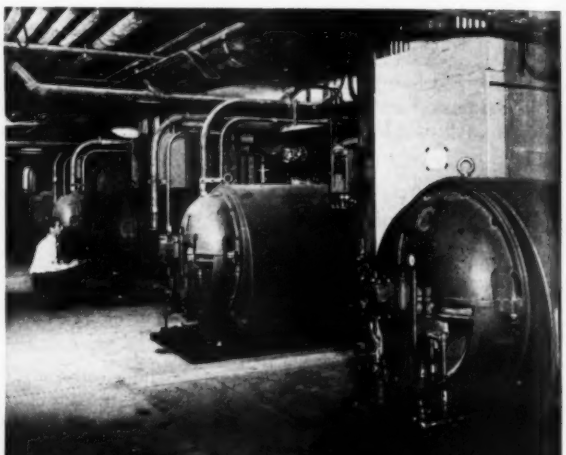

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Six of the nine 1000-hp GE motors that were recently placed into operation by the Los Angeles Department of Water and Power in the Harbor Steam Plant at Wilmington, Calif. Installation of the motors is part of a multi-million dollar expansion program that has been undertaken to keep pace in the tremendous western industrial and residential expansion

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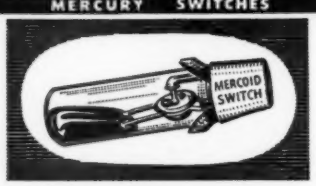

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THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, or fluid level.

If you have a problem on the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff—always at your service.

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MANUFACTURERS OF AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND NUMEROUS INDUSTRIAL APPLICATIONS. ALSO MERCOID BRAND MERCURY SWITCHES

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Playing host to the industrial and business press, The Resinous Products Div. of Rohm & Haas Co. introduced a basic advance in ion exchangers involving intimate mixtures of anion and cation resins in a single bed, which has been under development the past two years.

The new process, in which various forms are termed Amberlite Monobeds, (1) uses simpler and potentially less costly equipment, (2) is capable of more complete deionization than the two-bed system, (3) is easier to operate, (4) reduces rise requirements and costs less to regenerate, (5) permits constant maintenance of neutral pH during deionization, (6) makes feasible an indicating bed, which warns of exhaustion by a change in color, and (7) exhibits an extremely sharp breakthrough, permitting fuller utilization of the resins' capacity.

The Monobeds range from the MB-1, which produces water with the phenomenal electrical resistance of 10,000,000 ohms or more per cubic centimeter (a resistance obtainable otherwise only after several distillations in quartz), to one that produces water adequate for irrigation by a mere reduction of ionic solids in brackish waters.

U. S. Civil Service Commission

Examinations have been announced for Superintendent, Power System Operations, $7,600; Chief, Power System Dispatcher, $6,400; and Chief, Power System Technical Analysis Section, $6,400. Location of work to be at the Parker-Davis System, which includes Parker Power Plant, Davis Power Plant, and Hoover Power Plant. Examining circular EC 13-1-1 (1950). Application blanks available at any U. S. Civil Service Regional Office. No closing date.

EVICTION NOTICE!

Dirt, Dust, and Grit move out of their lodgings fast when a CLEMENTS-CADILLAC blower-suction cleaner is pointed their way. Use it regularly to evict the three trouble makers from every crack and crevice of your machinery and equipment. There's no better, faster, more economical way to do it.

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PREVENT DAMAGE TO MACHINERY WITH THE . . .

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PORTABLE COMBINATION BLOWER-SUCTION CLEANER

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***Any* CONTROL ASSEMBLY**
ON A STANDARD VALVE BODY

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Cylindrical ends on all valve bodies (in respective sizes) are identical, making possible *any control assembly.* Internally, stem, spacer, packer spreader, flange end bearings, and spring are interchangeable. Save on maintenance and stock; save by paying less for valves which embody standardized parts.

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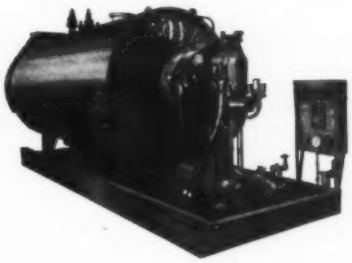

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Fully Automatic. Heavy Oil, No. 6.

60 to 500 Horsepower plus ample overload.

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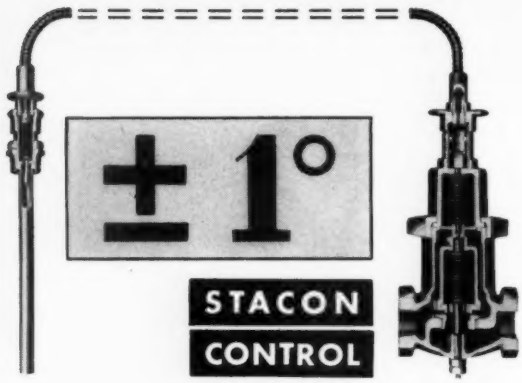

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R&I Stic-tite Insulating Cement

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Boiler Houses Are Necessary Evils", February, 1950.
"Caribou Diesel Plant Built in a Hurry", February, 1950.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . . " October, 1949.
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"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
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"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Low Cost Auxiliary Power From Turbine Drives", April, 1950.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Cattell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

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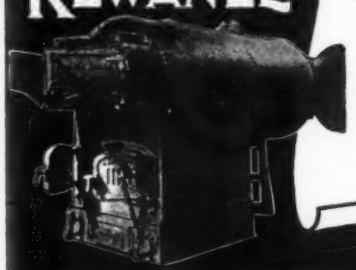

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100, 125, 150 lbs. W. P.

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Division of American Radiator & Standard Sanitary Corporation

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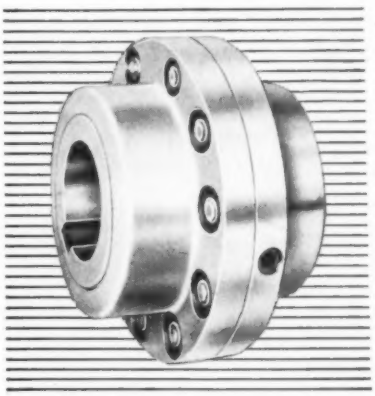

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the advanced gear type

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- STEAM GENERATORS
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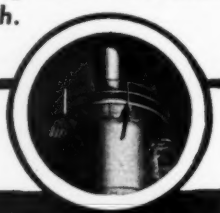

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An Indication of the Products Featured by Advertisers and a list of all Advertisers of each of the following classes of products may be obtained from Readers' Guide Section. See page 26.

Boilers and Furnace Construction units
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Cleaners & Blowers
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Dust and Fly Ash Collecting Equipment
Electrical Equipment
Floor Repairs
Fuel Firing Equipment
Heat Exchangers
Heating, Ventilating and Air Conditioning
Instruments
Insulation
Lubrication
Maintenance
Material Handling
Packings & Gaskets
Pipe and Fittings
Plant Equipment
Power Transmission
Pumps
Refractories
Regulators & Controls
Steam Turbines and Engines
Tools and Small Specialties
Traps, Strainers and Separators
Valves
Water Treatment
Welding Equipment
Wire Rope
Miscellaneous